151774

REVISION 3

CENTRAL SUPPORT ZONE INVESTIGATION FIELD SAMPLING PLAN

ENVIRO-CHEM SUPERFUND SITE ZIONSVILLE, INDIANA

PREPARED FOR

ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION TRUST

PREPARED BY

DOW ENVIRONMENTAL INC.
PITTSBURGH, PENNSYLVANIA

DEI PROJECT NUMBER 2455.003

FEBRUARY 1995

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PGH-95-MJD-0249

February 27, 1995

Mr. Dion Novak
U.S. Environmental Protection Agency
Region V
77 West Jackson Boulevard
HSRL-6J
Chicago, Illinois 60604

Subject: Enviro-Chem Superfund Site
Central Support Zone Investigation
Field Sampling Plan
DEI Project Number 2455.003

Dear Mr. Novak:

Enclosed are two (2) copies of the Field Sampling Plan (FSP) for the Central Support Zone. This plan focuses on soil sampling in the central area of the support zone as presented in the February 9 meeting and described in your letter of February 22.

The Quality Assurance Project Plan (QAPP) for this work will be submitted on March 7, 1995.

A copy of this plan has been submitted to Tony Likins of IDEM and three copies have been sent to Frank Mahuta, CH2M Hill.

If you have any questions on this submittal, please feel free to call me at (412) 788-2717.

Sincerely,

Mark J. Dowiak

Mark J. Dowiak, P.E.
Project Manager

MJD/rks

Enclosures (2)

cc: T. Likins, IDEM
F. Mahuta, CH2M Hill
R. Ball, ERM North Central
N. Bernstein, N. W. Bernstein & Associates
J. Kyle, III, Barnes and Thornburg

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NUMBER

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1.0 INTRODUCTION

This Field Sampling Plan (FSP) presents the methods of soil sample collection and analyses for the proposed Central Support Zone Investigation (SZI) at the Environmental Conservation and Chemical Corporation (Enviro-Chem) Site. Section 1.0 presents the results of Site Preparation and Material Removal (SPMR) soil sampling efforts undertaken in 1993, an evaluation of the data collected in light of Consent Decree acceptable soil concentrations, and outlines the objectives of the SZI and the general project organization. Section 2.0 presents the sample locations and frequency. Sections 3.0 and 4.0 present sampling procedures and sample handling and analysis, respectively.

1.1 Background

Construction of the SPMR commenced on September 1, 1993. The effort included the demolition of buildings and removal of debris both inside and outside the remedial boundary and construction of the support zone and support zone facilities to the west of the remedial boundary. During excavation activities for the diversion channels, volatile organic constituents were detected in the central support zone area, along the western remedial boundary. Section 1.1.1 describes the previous sampling effort in the central support zone area. Figure 1-1 depicts sampling locations utilized during the SZI.

1.1.1 Central Support Zone Area

On October 8, 1993, during SPMR construction, soils exhibiting elevated photoionization detector (PID) readings were encountered during excavation of the south support zone diversion channel near the center area of the site in the vicinity of the old access road. The findings were reported to the U.S. EPA and detailed in SPMR Monthly Progress Reports Numbers 2 and 3 which covered the period between September 11, 1993 and November 11, 1993. The location of the area is represented by a bullet symbol on Figure 1-1 and occurs in a gravel layer approximately 1 foot below grade. This layer is approximately 1/2-foot thick and was exposed during the excavation activities to a length of approximately 5 feet. After this layer was identified, the diversion channel excavation efforts in this location were stopped, the excavated channel was backfilled, the excavation equipment was decontaminated, and the area was marked with caution tape.

The Enviro-Chem Trustee's Engineer (the Engineer) notified the U.S. EPA and the Indiana Department of Environmental Management (IDEM) and prepared the "Sampling and Analysis Plan for Diversion Channel Northwest of Concrete Pad" (the Hand Auger Investigation Plan) which was submitted to IDEM and the U.S. EPA on behalf of the Enviro-Chem Trustees on October 12, 1993. The U.S. EPA verbally provided comments on the plan on October 13. The Hand Auger Investigation Plan included soil boring by hand auger in the area of potential contamination, field screening by headspace analysis with an organic vapor analyzer (OVA), and laboratory analysis for Volatile Organic Compounds (VOCs) of selected soil samples. The field sampling was initiated on October 13, 1993.

The results of the field screening activities were reported in SPMR Monthly Progress Report Number 3. The screening and sampling locations, HA-1 through HA-20, are shown on Figure 1-1. Table 1-1 presents a summary of the field screening results. Auger refusal occurred in a discontinuous, packed gravel layer at the 0.5- to 1.5-foot interval at 14 of the 20 sample locations. Areal distribution of the detectable VOCs could not be reliably estimated by the field screening results. Additionally, one soil sample in the diversion channel area (support zone sample) and two samples west of the area (HA-3 and HA-16) were selected for laboratory analysis of VOCs by U.S. EPA's SW-846 Method 8240A. The sampling locations were selected to establish the soil concentrations at increasing distances west of the location of potential contamination and the remedial boundary.

The support zone sample (1.0 feet) and samples HA-3 (0.5 to 1.0 foot) and HA-16 (1.5 to 2.0 feet) were submitted to Heritage Laboratories, Inc. (Heritage) of Indianapolis, Indiana. The analytical results are summarized on Table 1-2. Certificates of Analysis are included in Appendix A. The analytical results indicate that the concentrations of VOCs decrease with increasing distance west of the remedial boundary. In fact, individual sample VOCs were not detected in the HA-3 and HA-16 samples above the site-specific acceptable soil concentrations (Table 3-1 Exhibit A of the Consent Decree entered September 1, 1991, Number 83-1419 C, U.S.D.C., Southern District of Indiana). By utilizing the criteria outlined in the Consent Decree (Exhibit A, Table 3-1 and Footnote 6), which defines the acceptable soil VOC constituent concentrations for soil cleanup verification based upon their mean concentration from a group of samples, no VOC constituent exceeded established acceptable soil concentrations.

1.2 SPMR Analytical Data Evaluation

Table 1-3 provides a summary of the western boundary analytical results compared to Exhibit A criteria. The central support zone area occurs along the boundary of the site in the vicinity of the former truck access road into the facility. The three soil samples collected at this location revealed the greatest concentration in the ditch along the western boundary of the site with decreasing concentrations in the support zone westward from the ditch. Although this area is relatively limited in size and the mean concentration of the samples does not exceed acceptable concentrations for any VOC constituent, additional soil sampling is proposed in this area to determine the extent of VOC constituents in proximity to the site and to obtain a more representative sample group to evaluate cleanup levels.

1.3 Objectives of Support Zone Investigation Sampling

Soil samples will be taken during the support zone investigation to assess the horizontal and vertical (to 10 feet) extent of volatile organic compounds (VOCs) in the area of the central support zone.

1.4 Project Organization

The Support Zone Investigation (SZI) will be conducted by Dow Environmental Inc. (DEI). DEI shall designate a Site Manager to direct the SZI in the field. DEI shall also utilize subcontractors for soil borings, offsite laboratories (CLP analyses), and other services, as necessary. All SZI activities will be overseen by the Enviro-Chem Trustees Project Manager or his designated field representative.

It is anticipated that U.S. EPA and IDEM or their designated representatives will be present during the SZI to participate in data evaluations and field decisions for directing the SZI.

2

2.0 SAMPLE LOCATIONS AND FREQUENCY

This section presents the approach for determination of the sample locations and frequency for this investigation. Figure 2-1 provides initial grid sample locations.

2.1 General Approach

Twelve test borings will be drilled on a 50-foot spaced grid to obtain subsurface soil samples for VOC analysis in the central support zone area. Soil boring locations are shown on Figure 2-1. Each borehole will be drilled utilizing hollow stem augers. Samples will be obtained continuously on 2-foot intervals to a depth of 10 feet by split-barrel samplers. Each sample will be screened utilizing a photoionization detector (PID) to determine gross VOC concentration. In addition to the screened sample, a portion of each sample obtained will also be placed in a laboratory VOC sample jar in the event that the sample will be submitted for laboratory analysis. At a minimum, two samples from each borehole will be submitted for VOC analysis. One sample will be submitted from the 0- to 5-foot interval and a second sample will be submitted from the 5- to 10-foot interval. Additional samples may be taken from a boring based on field conditions (see Section 2.2).

If laboratory analysis results for any of the west or south perimeter grid sample points exceed the acceptable soil concentration values in Table 1-3, the grid will be expanded further in that direction along the gridline for a distance of 50 feet, or less. All additional grid sample borings will have a minimum of two soil samples submitted for VOC analysis.

2.2 Laboratory Sample Selection Criteria

The criteria for offsite laboratory samples from a given boring location will be based upon sample headspace readings and depth.

Additionally, a minimum of 10 percent of the offsite samples will represent nondetectable headspace values in order to quantify the entire VOC concentration range in samples collected. The initial selection criteria to be applied will be sample depth. One sample from each boring will be submitted from the 0- to 5-foot interval and an additional sample will be submitted from the 5- to 10-foot interval. This criteria will ensure that adequate vertical delineation of the area is achieved. The second criteria for laboratory sample selection will be field screening results. In general, the highest recorded headspace values from the upper and lower 5-foot intervals shall be selected.

3

3.0 SAMPLING PROCEDURES

This section summarizes the field procedures to be utilized during the SZI. Appendix B contains Standard Operating Procedures (SOPs) applicable to this project. For any discrepancies that exist between the SOPs and the procedures described below, the following sections shall take precedent over the SOPs.

3.1 Test Boring Drilling and Sampling

Initially, a grid sample network will be established as shown on Figure 2-1. The grid network will be referenced to the Indiana State Plane Coordinate System. Survey work will be conducted by an Indiana State Registered Surveyor.

All borings will be drilled at the grid location by hollow stem augering techniques. Split spoon samples will be taken continuously from 0 to 10 feet using a clean decontaminated sampling spoon. Each sample collected will be logged by the site geologist in accordance with the Unified Soil Classification System. A 4-ounce portion of each sample will be containerized for VOC field screening via headspace analysis. A portion of the remaining sample will be containerized in a VOC sample jar for potential submittal to the offsite laboratory, based upon field screening results. A decontaminated stainless steel trowel will be utilized to transfer soil into sample jars. The field geologist will wear a clean pair of latex gloves when handling samples. Drilling will terminate at a depth of 10 feet at each boring. All borings will be grouted with a cement/bentonite slurry upon completion of data acquisition activities.

If shallow perched water is encountered during drilling, the saturated interval will be carefully noted during logging activities. The presence of saturated soil shall not affect soil sampling procedures or selection criteria.

3.2 Field Screening Procedures

A portion of each soil sample will be submitted for field screening utilizing a photoionization detector (PID). The sample shall be representative of the candidate laboratory sample, which will also be collected from the split spoon at the time of sample retrieval. If two distinctly different soil types are encountered within a sample, each portion should be screened separately assuming an adequate sample volume is available.

Each screened soil sample will consist of a half-filled 8-ounce glass jar. The jar will be filled using a clean decontaminated stainless steel spatula. The top of the jar will be sealed with aluminum foil secured over the jar with a rubber band. The samples will be maintained at room temperature (approximately 70°F) for a minimum of 15 minutes prior to analysis to allow adequate time for equilibrium of any soil gas that may be contained in the jar. After reaching equilibrium, the soil gas samples will be analyzed by a PID with a 10.2 electron volt ionization lamp. The probe from the PID will be inserted through the foil cover and a peak reading of the resultant PID response will be recorded.

After all readings are completed for a sample location, the glass jar will be emptied of the remaining sample and decontaminated as per Section 3.4. A further description of this field screening method is contained in Appendix B, Headspace Analysis for Soils.

3.3 Preparation of Quality Assurance/Quality Control Samples

Quality Assurance/Quality Control (QA/QC) soil samples will be collected. The frequency of QA/QC samples will be: (1) one sample will be designated for MS/MSD analysis for every 20 or fewer samples, and (2) one duplicate will be collected for every 10 or fewer soil samples.

3.3.1 Field Duplicate Soil Samples

Duplicate soil samples will be collected in accordance with the procedure described below:

1. The investigative sample location from which a duplicate sample will be collected will be determined.

2. A duplicate sample will be obtained from the same sample spoon containing the sample to be analyzed. The sample will be divided in half longitudally utilizing a stainless steel trowel. Each divided half will comprise the sample and its duplicate. The samples will not be mixed or composited but will be inserted into the container in a manner which least disturbs the soil matrix.

3. The field notebook, labels, tags, and chain-of-custody sheets will be filled out with the duplicate sample properly designated and logged.

3.3.2 MS/MSD Soil Samples

The soil samples designated for MS/MSD analysis will be collected following the same procedure as other investigative samples. No extra sample volume is required. The investigative samples selected for MS/MSD analysis will be properly designated and logged on the chain-of-custody sheets, labels, tags, and in the field notebook. MS/MSD samples will be preserved, handled, and shipped following the same procedures as investigative samples.

3.4 Decontamination

All sampling equipment will be decontaminated prior to collection of each sample. Sampling gloves will be discarded after collecting each sample. Decontamination of field personnel will be conducted in accordance with the procedures specified in the SPMR Health and Safety Plan. Temporary exclusion zones and contamination reduction zones will be established by the Site Manager in accordance with the site HASP. Equipment will be decontaminated either near the sample location in heat-resistant plastic tubs or on the concrete decontamination pad in the support zone.

A pump will be used to remove contaminated water from the decontamination pad (if utilized) into drums that will be relocated to the drum storage area on the concrete pad.

Decontamination of the soil sampling spoons and other sampling equipment will be conducted via steam cleaning or according to the following procedure:

- Step 1 - Wash equipment with a solution of Alconox or phosphate detergent mixed with potable water

- Step 2 - Rinse with potable water

- Step 3 - Rinse with ethanol

- Step 4 - Rinse twice with distilled water

- Step 5 - Air dry

- Step 6 - Place in clean polyethylene bag or wrap in aluminum foil with shiny side out when not in use and during transport

Drilling rods will be decontaminated by steam cleaning or the above procedure prior to each new boring.

3.5 Documentation

All field measurements and observations will be recorded in both a field notebook and on the soil boring logs. Field measurements will include: distances, depths, and organic vapor concentrations. Field observations will consist of: weather conditions, physical appearance of samples, description of all field tasks undertaken, and a list of all personnel on site.

3.5.1 Field Notebooks

The field notebooks will be permanently labeled with the site name, site location, internal project number, and notebook number. Telephone numbers of key project personnel and safety agencies, such as the fire department, hospital, and police, will be indicated in each field notebook.

Each page in the field notebook will be numbered and dated at the time of use, and initialed at the bottom by the user. Daily entries will begin with a synopsis of weather conditions, field conditions, personnel present, and projected work tasks for the day. All field tasks completed and the status of tasks in progress will be recorded in the field notebook. Entries will include all field measurements, calibration and preventive maintenance of field instruments, sampling locations, type of sample, sample number, physical appearance of sample, and the names of sampling personnel. No erasing will be allowed, and corrections will be made by drawing a single line through the incorrect entry. All corrections of recorded data will be initialed and dated. Appendix B contains additional details regarding logbook entries in the field notebook SOP.

3.5.2 Soil Boring Logs

Field measurements and detailed documentation of sampling will be recorded on soil boring logs that will identify the site, sampling personnel, location of the sample, field classification of materials encountered, and all other field measurements obtained. Appendix B provides a sample log form that will be utilized for this project.

As with the field notebook, any corrections on the field data forms will be made by drawing a single line through the incorrect entry and initialing and dating the correction.

4

4.0 SAMPLE HANDLING AND ANALYSIS

Soil samples will be submitted for offsite analyses for TCL VOCs by using the most recent U.S. EPA-approved version of CLP SOW OLM01.8.

4.1 Sample Identification Label

Sample identification labels will include the following information:

- Sample designation
- Name of collector
- Affiliation of collector
- Date and time of collection
- Field screen or laboratory
- Requested analysis
- Analysis code

Each sample taken during the execution of this plan will be given a sample designation. The sample designation will be as follows:

EC	=	Enviro-Chem
B##	=	Soil boring number (to be determined in the field)
A,B,C,..	=	Depth interval (A for 0 to 2 feet, B for 2 to 4 feet, C for 4 to 6 feet, etc.)
S	=	Soil sample
F or L	=	Field screen or L for laboratory analysis

A soil sample collected at the 4- to 6-foot depth interval from soil boring number 2 submitted for field VOC headspace screening analysis would be labeled as "ECB02CSF". A soil sample collected at the 0- to 2-foot depth interval from soil boring 11 submitted to the offsite laboratory would be labeled "ECB11ASL". Information from the sample identification labels will be recorded in the field notebook to document all analytical samples. In addition, the soil boring grid coordinate will be recorded as identified by field survey (see Figure 2-1).

4.2 Sample Seals

If the soil samples are to be transported by a carrier, the cooler containing the samples will be sealed to prevent disturbance of the samples during transportation. The seal will be affixed in such a manner that it would be broken if the cooler were to be opened. Upon receipt of the samples, the laboratory will check the integrity of the seal.

4.3 Chain-of-Custody Form

To provide documentation necessary to trace sample possession from the time of collection to the time of receipt by the analytical laboratory, a chain-of-custody record will be completed and accompany each shipment of sample(s) to the laboratory. Chain-of-custody procedures are discussed in Section 4.4. A copy of the sample chain-of-custody form is included in Appendix B. Copies will be stored in the project files.

4.4 Sample Shipment and Custody Procedures

Sample custody procedures will be consistent with the U.S. EPA Region V Guidance "Content Requirements for Quality Assurance Project Plans."

A sample will be considered under the person's custody if it is: (1) in a person's physical possession, (2) in view of the person after taking possession, (3) secured by that person so that no one can tamper with the sample, or (4) secured by that person in an area that is restricted to authorized personnel. The sample packaging and shipment procedures summarized below will assure that the sample will arrive at the laboratory with the chain-of-custody intact.

Field procedures are as follows:

- The field sampler will be personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible will handle the samples.

- All samples will be tagged with sample numbers and locations.

- Sample tags will be completed for each sample using waterproof ink unless prohibited by weather conditions.

Transfer-of-custody and shipment procedures will be as follows:

- Samples will be accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the records. This record documents the transfer of custody of samples from the sampler to another person, to the chemist operating the field screening analytical unit, to the offsite laboratory, or to/from a secure storage area.

- Samples will be properly packaged for shipment and dispatched via overnight courier or hand delivered to the field screening operator or laboratory for analysis, with a separate, signed custody record enclosed in a cooler. Shipping containers will be secured with packing tape and custody seals for shipment to the laboratory.

- The original chain-of-custody record and the yellow and pink copies will accompany the shipment. The gold copy will be retained by the samplers and returned to the field office.

The specifications for chain-of-custody and document control for the analytical laboratory will be discussed in the QAPP.

4.5 Analytical Procedures

Soil samples will be submitted to the offsite laboratory for confirmatory analysis of TCL VOCs by using the most recent U.S. EPA-approved version of CLP SOW OLM01.8. The requirements for precision, accuracy, completeness, representativeness, and comparability will be described in the QAPP.

4.6 Field Quality Assurance/Quality Control Procedures

The QA/QC procedures will be followed to ensure the reliability and validity of the field and analytical data obtained during the investigation.

Field QA/QC procedures include calibration of field instruments and collection of field duplicate and MS/MSD samples. MS/MSD and field duplicate samples will be prepared as described in Section 3.3.2.

DEI's Site Manager will monitor and audit the performance of field QA/QC procedures by reviewing the detailed description of sample collection and field measurement procedures recorded in the field notebook to ensure that this investigation is executed in accordance with this FSP.

4.7 Corrective Action

If a problem occurs in the field that is immediately correctable by direct action, then the DEI's Site Manager will see that the action is taken. For example, if poor sampling techniques are observed when collecting a sample, the Site Manager will order the recollection of a new sample and indicate the steps to be taken to prevent a reoccurrence of the problem.

Some problems are not immediately correctable in the field. If such a problem is encountered, the Site Manager will contact the Enviro-Chem Project Manager, who will then determine the appropriate corrective action in consultation with the U.S. EPA and IDEM, if necessary.

4.8 Data Reduction and Validation

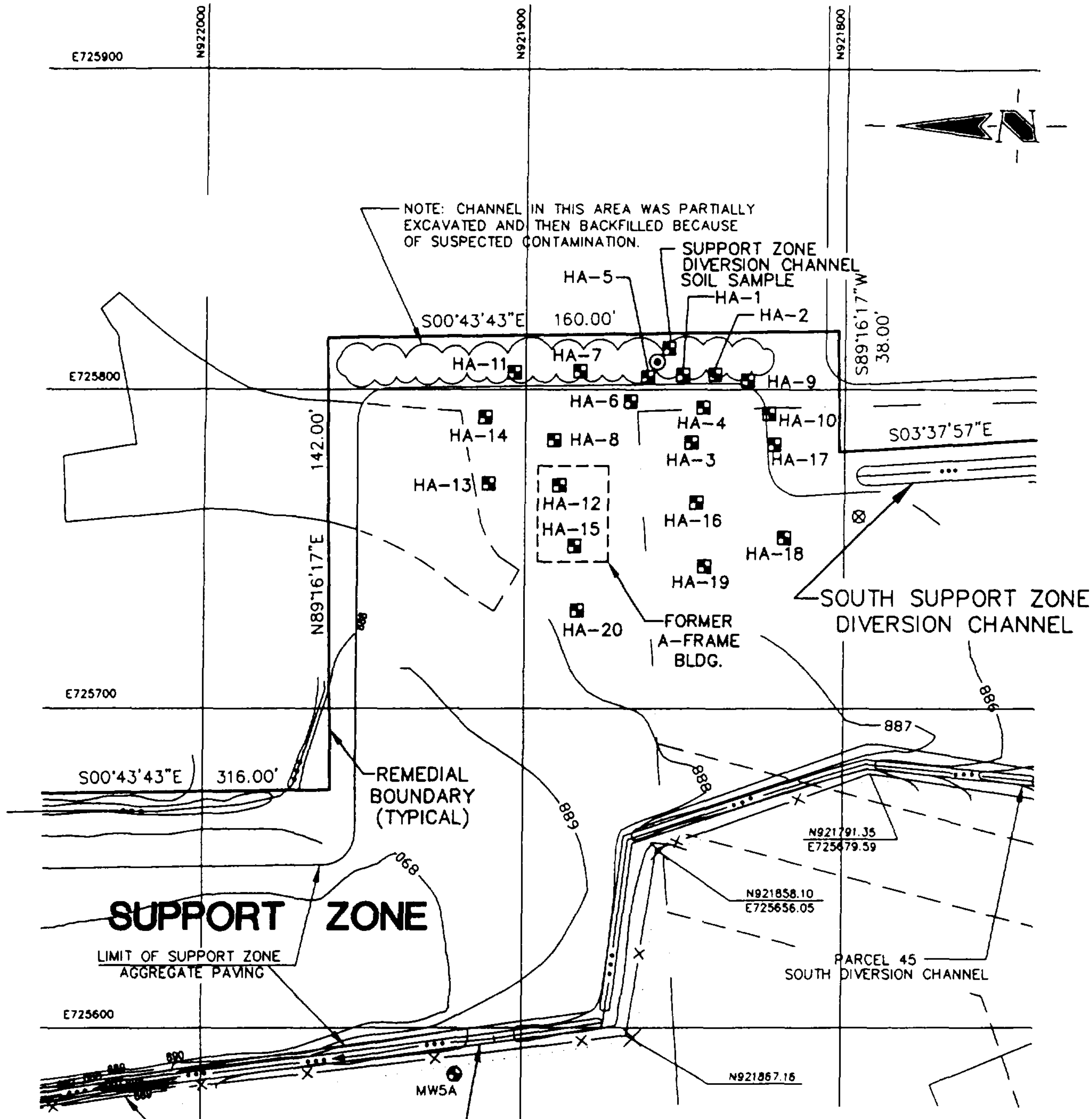
Offsite laboratory analytical data reduction will be carried out by the laboratory following the procedures in the most recent U.S. EPA-approved versions of the CLP SOWs. Analytical data validation will be performed by DEI using the U.S. EPA National Functional Guidelines. Additionally, the laboratory performing the analysis of the chemical parameters will critique its own analytical program by using spiked addition recoveries, established detection limits, and precision and accuracy control charts where applicable, and by keeping accurate records of the calibration of instruments as described in the most recent U.S. EPA-approved version of the CLP SOWs. Data reduction and validation procedures will be described in the QAPP. The laboratory will provide documentation to meet the requirements of the QAPP.

4.9 Data Evaluation and Reporting

Field and analytical data will be evaluated, summarized, and presented in a report to be submitted to the U.S. EPA after the completion of the field activities. Detected soil concentrations will be compared with the site-specific acceptable soil concentrations. The report will also include a description of all field activities, analytical procedures, and any modifications to this Field Sampling Plan.

FIGURES

FIGURES



NOTES:

1. COORDINATE GRID IS REFERENCED TO THE INDIANA STATE PLANE COORDINATE SYSTEM.
2. BASE MAP TAKEN FROM AWD TECHNOLOGIES SITE PREPARATION AND MATERIALS REMOVAL CONTRACT AS-BUILT DRAWING AB-1.

PARCEL 45
BOONE COUNTY RESOURCE RECOVERY SYSTEMS, INC.
D.R. 243, PG. 623

SITE SECURITY FENCE (TYP.)

PARCEL 45 NORTH DIVERSION CHANNEL

N922000

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SCALE IN FEET

LEGEND

- HA-19 ■ HAND AUGER INVESTIGATION SOIL SAMPLE LOCATION
- ⊙ LOCATION OF ELEVATED PID READINGS FOUND DURING SPMR WORK
- ⊕ EXISTING MONITORING WELL (APPROXIMATE LOCATION)
- ⊗ EXISTING UTILITY POLE WITH DUSK TO DAWN LIGHT (APPROXIMATE LOCATION)

FILE: \ECC\SUPPORTS

Dow Environmental

HAND AUGER INVESTIGATION (1993) SOIL SAMPLE LOCATIONS

ENVIRO-CHEM SUPERFUND SITE — ZIONSVILLE, IN

CLIENT:	ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION TRUST	JOB NUMBER:	2455-003
SCALE: AS SHOWN	FIGURE NUMBER 1-1		REV 0

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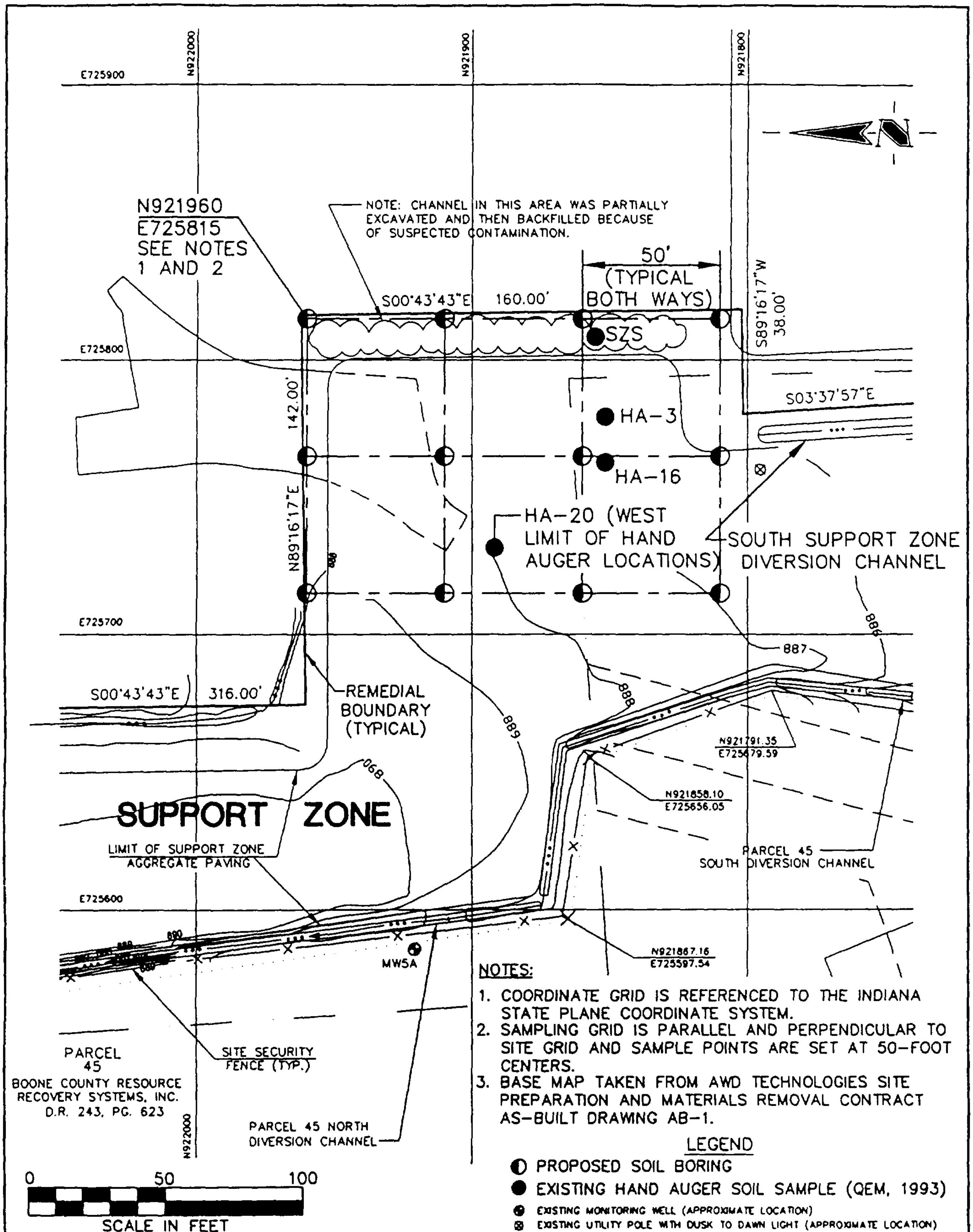

NOTES:

1. COORDINATE GRID IS REFERENCED TO THE INDIANA STATE PLANE COORDINATE SYSTEM.
2. SAMPLING GRID IS PARALLEL AND PERPENDICULAR TO SITE GRID AND SAMPLE POINTS ARE SET AT 50-FOOT CENTERS.
3. BASE MAP TAKEN FROM AWD TECHNOLOGIES SITE PREPARATION AND MATERIALS REMOVAL CONTRACT AS-BUILT DRAWING AB-1.

LEGEND

- ◐ PROPOSED SOIL BORING
- ● EXISTING HAND AUGER SOIL SAMPLE (QEM, 1993)
- EXISTING MONITORING WELL (APPROXIMATE LOCATION)
- EXISTING UTILITY POLE WITH DUSK TO DAWN LIGHT (APPROXIMATE LOCATION)

FILE: \ECC\SUPPORT4

DOW
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CENTRAL SUPPORT ZONE INVESTIGATIONS
SOIL SAMPLING GRID LOCATIONS

ENVIRO-CHEM SUPERFUND SITE — ZIONSVILLE, IN

CLIENT:	ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION TRUST	JOB NUMBER:	2455-003
SCALE: AS SHOWN	FIGURE NUMBER 2-1		REV 0

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TABLES

TABLES

TABLE 1-1

SOIL SAMPLING HEAD SPACE RESULTS
HAND AUGER INVESTIGATION (1)
ENVIROCHEM SITE
ZIONSVILLE, INDIANA

DEPTH BGS (feet)	HA-1 OVA READINGS	HA-2 OVA READINGS	HA-3 OVA READINGS	HA-4 OVA READINGS	HA-5 OVA READINGS	HA-6 OVA READINGS	HA-7 OVA READINGS	HA-8 OVA READINGS	HA-9 OVA READINGS	HA-10 OVA READINGS
0.0 - 0.5	10	24	1	0	7	50	40	>1,000	62	1
0.5 - 1.0	220	NS AR	1.5 S	0	>1,000	220	79	>1,000	9	0
1.0 - 1.5	NS AR	NS	NS	0	NS AR	NS AR	NS AR	NS AR	0	20
1.5 - 2.0	NS	NS	3	0.5	NS	NS	NS	NS	0	10
2.0 - 2.5	NS	NS	NS	0.5	NS	NS	NS	NS	1	34
2.5 - 3.0	NS	NS	16	0	NS	NS	NS	NS	3	50
3.0 - 3.5	NS	NS	NS	1.5	NS	NS	NS	NS	6	200
3.5 - 4.0	NS	NS	0.5	4.5	NS	NS	NS	NS	NS AR	850
4.0 - 4.5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS AR
4.5 - 5.0	NS	NS	1	NS	NS	NS	NS	NS	NS	NS

DEPTH BGS (feet)	HA-11 OVA READINGS	HA-12 OVA READINGS	HA-13 OVA READINGS	HA-14 OVA READINGS	HA-15 OVA READINGS	HA-16 OVA READINGS	HA-17 OVA READINGS	HA-18 OVA READINGS	HA-19 OVA READINGS	HA-20 OVA READINGS
0.0 - 0.5	2	4	NS AR	NS AR	23	15	55	58	600	34
0.5 - 1.0	NS AR	42	NS	NS	9	33	NS AR	14	>1000	97
1.0 - 1.5	NS	NS AR	NS	NS	NS AR	700	NS	NS AR	620	NS AR
1.5 - 2.0	NS	NS	NS	NS	NS	1000 S	NS	NS	400	NS
2.0 - 2.5	NS	NS	NS	NS	NS	300	NS	NS	NS AR	NS
2.5 - 3.0	NS	NS	NS	NS	NS	210	NS	NS	NS	NS
3.0 - 3.5	NS	NS	NS	NS	NS	280	NS	NS	NS	NS
3.5 - 4.0	NS	NS	NS	NS	NS	110	NS	NS	NS	NS
4.0 - 4.5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
4.5 - 5.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Key:
OVA = Organic vapor analyzer.
NS = No sample.
BGS = Below ground surface.
S = Sample collected
AR = Auger refusal

Note:
(1) OVA headspace readings in Volumetric parts per million.

TABLE 1-2

SOIL SAMPLING ANALYTICAL RESULTS
HAND AUGER INVESTIGATION
ENVIROCHEM SITE
ZIONSVILLE, INDIANA

PARAMETERS	Acceptable Concentration (1)	Support Zone Sample	HA-3 0.5-1.0'	HA-16 1.5-2.0'
Volatile Organic Compounds (2)				
Methylene chloride	20	42	8	5
Toluene	238000	75	20	6
1,1,1-Trichloroethane	7200	710	74	11
Trichloroethene	240	73	21	7
Tetrachloroethene	130	320	ND	ND

Key:
HA = Hand auger sample.
ND = Not detected.

Notes:
(1) Reference: Table 3-1 Exhibit A Consent Decree.
(2) EPA Method (SW846-8240A) soil concentration in (ug/kg).

TABLE 1-3 COMPARISON OF WESTERN BOUNDARY RESULTS TO EXHIBIT A SOIL CLEANUP CRITERIA CENTRAL SUPPORT ZONE AREA			
PARAMETER	CENTRAL SUPPORT ZONE AVERAGE	ACCEPTABLE CONCENTRATION	NUMBER OF SAMPLES
METHYLENE CHLORIDE	18	25	3
TOLUENE	34	297500	3
1,1,1-TRICHLOROETHANE	265	9000	3
TRICHLOROETHENE	34	300	3
TETRACHLOROETHENE	108	163	3

NOTES:
ALL VALUES PROVIDED IN ug/kg .
THE ACCEPTABLE CONCENTRATION IS TAKEN FROM EXHIBIT A TABLE 3-1 AND FOOTNOTE 6 (TABLE 3-1 CONCENTRATIONS PLUS 25%)

APPENDICES

Printed on Recycled Paper

A

APPENDIX A

CERTIFICATES OF ANALYSIS - HAND AUGER INVESTIGATION

C E R T I F I C A T E   O F   A N A L Y S I S

Service Location	Received	Project	Lab ID
HERITAGE LABORATORIES, INC. 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8305	14-OCT-93	2506	A293253
	Complete: 03-NOV-93	PO Number:	
	Printed: 03-NOV-93	Sampled: 14-OCT-93 13:25	

Report To

ROBERT J. AUTIO
QUALITY ENVIRONMENTAL MANAGEMENT
1640 STRICKLAND
MARTINSVILLE, IN 46151

Bill To

CHARLES JACKSON
QUALITY ENVIRONMENTAL MANAGEMENT
RR 1, BOX 555
ROCKVILLE, IN 47872

Sample Description

DESCRIPTION: SUPP. ZONE DIVERSION CHANNEL

VOLATILE ORGANICS (HEATED PURGE & TRAP) SW846-8240A

Analyst: B. MAZUR   Analysis Date: 26-OCT-93 12:13   Instrument: GC/MS VOA   Test: 0510.9.0

Parameter	Result	Det. Limit	Units
ACETONE	BDL	100	ug/kg
ACROLEIN	BDL	250	ug/kg
ACRYLONITRILE	BDL	350	ug/kg
BENZENE	BDL	25	ug/kg
BROMODICHLOROMETHANE	BDL	25	ug/kg
BROMOFORM	BDL	25	ug/kg
BROMOMETHANE	BDL	50	ug/kg
CARBON DISULFIDE	BDL	25	ug/kg
CARBON TETRACHLORIDE	BDL	25	ug/kg
CHLOROBENZENE	BDL	25	ug/kg
CHLOROETHANE	BDL	50	ug/kg
CHLOROFORM	BDL	25	ug/kg
CHLOROMETHANE	BDL	50	ug/kg
DIBROMOCHLOROMETHANE	BDL	25	ug/kg
CIS-1,3-DICHLOROPROPENE	BDL	25	ug/kg
DICHLORODIFLUOROMETHANE	BDL	25	ug/kg
1,1-DICHLOROETHANE	BDL	25	ug/kg
1,2-DICHLOROETHANE	BDL	25	ug/kg
1,1-DICHLOROETHENE	BDL	25	ug/kg
1,2-DICHLOROPROPANE	BDL	25	ug/kg
ETHYLBENZENE	BDL	25	ug/kg
FLUOROTRICHLOROMETHANE	BDL	25	ug/kg
2-HEXANONE	BDL	50	ug/kg
METHYLENE CHLORIDE	42	25	ug/kg
METHYL ETHYL KETONE	BDL	50	ug/kg
4-METHYL-2-PENTANONE	BDL	50	ug/kg
STYRENE	BDL	25	ug/kg
1,1,2,2-TETRACHLOROETHANE	BDL	25	ug/kg
TETRACHLOROETHENE	320	25	ug/kg
TETRAHYDROFURAN	BDL	120	ug/kg
TOLUENE	75	25	ug/kg
1,2-DICHLOROETHENE (TOTAL)	BDL	25	ug/kg
TRANS-1,3-DICHLOROPROPENE	BDL	25	ug/kg
1,1,1-TRICHLOROETHANE	710	25	ug/kg
1,1,2-TRICHLOROETHANE	BDL	25	ug/kg

Lab Sample ID: A293253

HERITAGE LABORATORIES, INC.

Parameter	Result	Det. Limit	Units
TRICHLOROETHENE	73	25	ug/kg
VINYL ACETATE	BDL	50	ug/kg
VINYL CHLORIDE	BDL	50	ug/kg
XYLENE (TOTAL)	BDL	25	ug/kg
SURROGATE RECOVERY			
DICHLOROETHANE-D4	95		% Rec
TOLUENE-D8	104		% Rec
BROMOFLUOROBENZENE	98		% Rec

1:5 DILUTION.

Sample Comments

BDL Below Detection Limit

Sample chain of custody number 10936.

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RR 1, BOX 555, ROCKVILLE, IN 47872

Quality Assurance Officer: [signature]

LIST OF COMPLETED TASKS

GC/MS CLP GC/MS CLP Completed 03-NOV-93

C E R T I F I C A T E   O F   A N A L Y S I S

Service Location	Received	Project	Lab ID
HERITAGE LABORATORIES, INC. 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8305	28-OCT-93	2506	A294793
	Complete	PO Number	
	08-NOV-93	....	
	Printed	Sampled	
	09-NOV-93	19-OCT-93 16:30	

Report To	Bill To
ROBERT J. AUTIO QUALITY ENVIRONMENTAL MANAGEMENT 1640 STRICKLAND MARTINSVILLE, IN 46151	CHARLES JACKSON QUALITY ENVIRONMENTAL MANAGEMENT RR 1, BOX 555 ROCKVILLE, IN 47872

Sample Description

DESCRIPTION: HA-3 (0.5-1.0')
LOCATION: ENVIROCHEM - SITE PREP & MATERIAL REMOVAL

/OLATILE ORGANICS (HEATED PURGE & TRAP) SW846-8240A

Analyst: G. WILSON   Analysis Date: 01-NOV-93 11:05   Instrument: GC/MS VOA   Test: 0510.9.0

Parameter	Result	Det. Limit	Units
ACETONE	BDL	20	ug/kg
ACROLEIN	BDL	50	ug/kg
ACRYLONITRILE	BDL	70	ug/kg
BENZENE	BDL	5	ug/kg
BROMODICHLOROMETHANE	BDL	5	ug/kg
BROMOFORM	BDL	5	ug/kg
BROMOMETHANE	BDL	10	ug/kg
CARBON DISULFIDE	BDL	5	ug/kg
CARBON TETRACHLORIDE	BDL	5	ug/kg
CHLOROBENZENE	BDL	5	ug/kg
CHLOROETHANE	BDL	10	ug/kg
CHLOROFORM	BDL	5	ug/kg
CHLOROMETHANE	BDL	10	ug/kg
DIBROMOCHLOROMETHANE	BDL	5	ug/kg
CIS-1,3-DICHLOROPROPENE	BDL	5	ug/kg
DICHLORODIFLUOROMETHANE	BDL	5	ug/kg
1,1-DICHLOROETHANE	BDL	5	ug/kg
1,2-DICHLOROETHANE	BDL	5	ug/kg
1,1-DICHLOROETHENE	BDL	5	ug/kg
1,2-DICHLOROPROPANE	BDL	5	ug/kg
ETHYLBENZENE	BDL	5	ug/kg
FLUOROTRICHLOROMETHANE	BDL	5	ug/kg
2-HEXANONE	BDL	10	ug/kg
METHYLENE CHLORIDE	8	5	ug/kg
METHYL ETHYL KETONE	BDL	10	ug/kg
4-METHYL-2-PENTANONE	BDL	10	ug/kg
STYRENE	BDL	5	ug/kg
1,1,2,2-TETRACHLOROETHANE	BDL	5	ug/kg
TETRACHLOROETHENE	BDL	5	ug/kg
TETRAHYDROFURAN	BDL	25	ug/kg
TOLUENE	20	5	ug/kg
1,2-DICHLOROETHENE (TOTAL)	BDL	5	ug/kg
TRANS-1,3-DICHLOROPROPENE	BDL	5	ug/kg
1,1,1-TRICHLOROETHANE	74	5	ug/kg

 (continued on next page)

Parameter	Result	Det. Limit	Units
1,1,2-TRICHLOROETHANE	BDL	5	ug/kg
TRICHLOROETHENE	21	5	ug/kg
VINYL ACETATE	BDL	10	ug/kg
VINYL CHLORIDE	BDL	10	ug/kg
XYLENE (TOTAL)	BDL	5	ug/kg
SURROGATE RECOVERY			
DICHLOROETHANE-D4	111		% Rec
TOLUENE-D8	98		% Rec
BROMOFLUOROBENZENE	103		% Rec

Sample reanalyzed with no improvement in internal standard areas.

Sample Comments

BDL Below Detection Limit

Sample chain of custody number 13243.

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RR 1, BOX 555, ROCKVILLE, IN 47872

Quality Assurance Officer: GABusch

C E R T I F I C A T E   O F   A N A L Y S I S

Service Location	Received	Project	Lab ID
HERITAGE LABORATORIES, INC. 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8305	29-OCT-93	2506	A295096
	Complete	PO Number	
	11-NOV-93	9311001-RJA	
	Printed	Sampled	
	11-NOV-93	29-OCT-93 14:25	

Report To

ROBERT J. AUTIO
QUALITY ENVIRONMENTAL MANAGEMENT
1640 STRICKLAND
MARTINSVILLE, IN 46151

Bill To

CHARLES JACKSON
QUALITY ENVIRONMENTAL MANAGEMENT
RR 1, BOX 555
ROCKVILLE, IN 47872

Sample Description

DESCRIPTION: HA-16 (1.5-2.0')

)LATILE ORGANICS (HEATED PURGE & TRAP) SW846-8240A

nalyst: G. WILSON   Analysis Date: 04-NOV-93 06:10   Instrument: GC/MS VOA   Test: 0510.9.0

Parameter	Result	Det. Limit	Units
:ETONE	BDL	20	ug/kg
:ROLEIN	BDL	50	ug/kg
:RYLONITRILE	BDL	70	ug/kg
:NZENE	BDL	5	ug/kg
:OMODICHLOROMETHANE	BDL	5	ug/kg
:OMOFORM	BDL	5	ug/kg
:OMOMETHANE	BDL	10	ug/kg
RBON DISULFIDE	BDL	5	ug/kg
RBON TETRACHLORIDE	BDL	5	ug/kg
LOROBENZENE	BDL	5	ug/kg
LOROETHANE	BDL	10	ug/kg
LOROFORM	BDL	5	ug/kg
LOROMETHANE	BDL	10	ug/kg
BROMOCHLOROMETHANE	BDL	5	ug/kg
S-1,3-DICHLOROPROPENE	BDL	5	ug/kg
CHLORODIFLUOROMETHANE	BDL	5	ug/kg
1-DICHLOROETHANE	BDL	5	ug/kg
2-DICHLOROETHANE	BDL	5	ug/kg
1-DICHLOROETHENE	BDL	5	ug/kg
2-DICHLOROPROPANE	BDL	5	ug/kg
HYLBENZENE	BDL	5	ug/kg
UOROTRICHLOROMETHANE	BDL	5	ug/kg
HEXANONE	BDL	10	ug/kg
THYLENE CHLORIDE	5	5	ug/kg
THYL ETHYL KETONE	BDL	10	ug/kg
METHYL-2-PENTANONE	BDL	10	ug/kg
YRENE	BDL	5	ug/kg
1,2,2-TETRACHLOROETHANE	BDL	5	ug/kg
TRACHLOROETHENE	BDL	5	ug/kg
TRAHYDROFURAN	BDL	25	ug/kg
.UENE	6	5	ug/kg
2-DICHLOROETHENE (TOTAL)	BDL	5	ug/kg
ANS-1,3-DICHLOROPROPENE	BDL	5	ug/kg
1,1-TRICHLOROETHANE	11	5	ug/kg
1,2-TRICHLOROETHANE	BDL	5	ug/kg

HERITAGE LABORATORIES, INC. Lab Sample ID: A295096

Parameter	Result	Det. Limit	Units
TRICHLOROETHENE	7	5	ug/kg
VINYL ACETATE	BDL	10	ug/kg
VINYL CHLORIDE	BDL	10	ug/kg
XYLENE (TOTAL)	BDL	5	ug/kg
SURROGATE RECOVERY			
DICHLOROETHANE-D4	94		% Rec
TOLUENE-D8	103		% Rec
BROMOFLUOROBENZENE	92		% Rec

Sample Comments

BDL Below Detection Limit

Sample chain of custody number 14434.

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Quality Assurance Officer: ____________________

L I S T O F C O M P L E T E D T A S K S

GC/MS CLP GC/MS CLP Completed 11-NOV-93

B

APPENDIX B

APPLICABLE STANDARD OPERATING PROCEDURES

TITLE:

SAMPLING EQUIPMENT
DECONTAMINATION

DATE: 07/91

REVISION NUMBER: 1

8.1 Scope

Decontamination of all analytical devices, sampling tools, and storage equipment that may come into direct contact with a field sample is necessary in order to achieve analytical results that are representative of true field conditions.

The decontamination procedures below may be modified as long as the chemical integrity of the field sample is maintained within the analytical detection limits and the sample source is not permanently compromised. Anticipated contaminates and concentrations, media (water, air, soil, etc.), surface area of possible cross contamination, method of sampling, and many other factors should be considered when establishing a sampling equipment decontamination procedure.

8.2 Definitions

Not used.

8.3 Equipment and Materials

The following equipment is needed for the general decontamination procedure:

- Clean disposable rubber gloves;
- wastewater container (drum);
- clean water spraying device;
- clean brushes;
- plastic garbage bags;
- ten percent nitric acid solution in squirt bottle (squirt bottle is not recommended for transportation);
- acetone or methanol in squirt bottle (squirt bottle is not recommended for transportation)
- nonphosphate detergent (Alconox);
- deionized/distilled water (DI water);

- clean buckets and other containers, as needed (small plastic swimming pool);
- plastic ground sheet (Visqueen);
- aluminum foil;
- package labels and pen;
- potable water, warm if available; and
- steam cleaner (optional).

8.4 Procedures

All equipment shall be considered contaminated unless documented otherwise. In order to provide consistency to the decontamination procedure, a specific location and person should be delegated with this duty. Similarly, it is desirable to decontaminate all the equipment necessary for a field task in the laboratory prior to mobilization. In this way, field decontamination will be limited.

The following steps are considered as AWD's general decontamination procedure:

- Cover hands with disposable rubber gloves;
- wash and scrub as necessary with a solution of nonphosphate detergent and potable water (warm water if available). Thorough steam cleaning may be used as a substitute for this step;
- rinse thoroughly with potable water (warm water if available);
- rinse with 10 percent nitric acid solution;
- rinse with DI water;
- rinse with acetone, hexane, or methanol;
- rinse with DI water; and
- air dry.

The nitric acid rinse is only required if inorganic (i.e., metals and general chemistry parameters) analysis is intended for the sample. The solvent rinse is only required for organic analysis.

All waste liquids and solids generated by the decontamination procedure should be containerized and disposed of properly.

After decontamination, the equipment must be packaged if it is not going to be used immediately. For packaging, the exposed sampling surfaces of the equipment must first be wrapped in aluminum foil. All decontaminated equipment not intended for immediate use must then be placed in plastic bags and sealed. These bags should be labeled and dated. The documentation procedure should be recorded in a documentation log or field logbook.

All handling of decontaminated equipment will be performed using disposable rubber gloves. Care must be exercised in the storage of decontaminated equipment. Avoid solvents, greases, oils, gasoline, water, dusts, and other potential sources that might contaminate the equipment before use.

8.4.1 Decontamination of Specific Equipment

Detailed below are decontamination considerations for some common field equipment.

Bailers

Two types of bailers are commonly employed for sampling. A one-liter stainless steel type with a Teflon® ball valve and a half-liter all Teflon® type. With the stainless steel type of bailer, special care should be taken not to lose the check valve ball and retaining rod that may slide out when the bailer is inverted.

In most cases, all bailers should be decontaminated at the laboratory prior to mobilization to the site. Packaging includes an aluminum foil wrap and storage in a closed plastic bag. Bailers should be dedicated for each well to be sampled. In this way, in-field decontamination of bailers is avoided.

Disposable three-strand 3/16-inch polypropylene rope is used for the bailer line. This rope should be disposed of appropriately after one use.

Plastic sheeting may be used around the base of the well head during sampling and any time sample spillage could occur.

Purging Pumps and Hose

Submersible pumps, suction pumps, and hose used for well development, pumping tests, well purging, etc., must have those surfaces that come into contact with liquids, which may be sampled, decontaminated prior to each use.

A submersible pump and some length of the outer wall of the discharge hose and wiring will come into direct contact with liquids that may be sampled during use. Therefore, this portion of the pump must undergo the decontamination procedure specified above; however, acid and solvents should not be used because they may damage the pump, hose, and wiring.

All submersible pumps should have a check valve at the discharge end. This valve stops previously pumped water in the discharge hose from flowing back through the pump when it is shut off. If a check valve is not available, the internals of the pump and discharge hose must be decontaminated prior to use. This is accomplished by pumping a sufficient quantity of the decontamination solutions in proper order through the pump and discharge hose.

Suction pumps should have a check valve on the end of the suction line, also. If this is the case, only the external wall of the suction hose anticipated to be in contact with the well liquids must be decontaminated. If a check valve is not available, then the suction hose, pump, and discharge hose must all be decontaminated prior to each use.

Water hose can leach or absorb organics (especially the phthalate esters). For this reason, direct contact between the hose and liquid that may be sampled should be kept at a minimum when sampling for organics. For this and other reasons, groundwater samples are generally not collected from a well by the purging pump but by use of a bailer. If the sample is intended to be collected from a pump discharge hose, decontamination of the pump and hose interior and exterior is required prior to use. In the case of organic sampling, Teflon® hose is ideal, if available. For all other sampling, Viton, polyethylene, or polyvinyl chloride are recommended (in order of preference).

Filter Equipment

Water samples for inorganic analysis are often filtered in the field prior to preservation of the metals. Two filtration systems are employed at AWD: a simple hand vacuum filter and the Geopump, an over-pressure peristaltic pump filter. Decontamination of these filter systems requires removal of the disposable filter and pumping of the decontamination solutions through the system in suitable amounts and in proper order. The nitric acid solution rinse is an important step in that it dissolves metals that have precipitated onto the surfaces of the equipment. Solvents should not be used because they will cause damage to the filtering equipment. For this and other reasons, samples intended for organic analysis should not be run through the filter system.

Probes

Many kinds of probes, such as thermometers, pH meters, conductivity meters, that may come in direct contact with the sample must be decontaminated. Modification of the above procedure may be necessary when decontaminating this equipment if manufacturers' instructions indicate otherwise. In most cases, direct contact by a probe with the analytical sample is not necessary. Additional liquid can usually be obtained and held in a separate container for measurements such as temperature, pH, and conductivity.

Water level indicators, recorders, and geophysical tools, which are immersed in the wells, should be decontaminated using the procedure specified above. However, concentration of contaminants, the relatively small surface area of the probe or float, well purging after the use of the probe or float, and the type of contaminate present are factors that should be considered on a site-by-site basis when determining decontamination procedures for this equipment.

Drilling and Excavating Equipment

Drilling and excavating equipment must have those pieces of the equipment that may come into contact with soil or liquids, which may be sampled, decontaminated. This would include all downhole equipment on drill rigs, such as the drill bit, the drilling rods, augers, and casing. For excavating equipment, this includes the digging shovel. Because of the size of the equipment and the incidental nature of any contact with liquids or soils, which may be sampled, this equipment is generally only steam cleaned prior to each hole or test pit.

Split-spoon samplers and Shelby tubes come into direct contact with samples intended for analytical analysis. For this reason, these items should undergo the general decontamination procedure unless a documented alternative decontamination plan has been approved by the project manager.

8.4.2 Important Note

The above guideline addresses only the decontamination of equipment as it pertains to the chemical integrity of samples for analysis. This guideline is not intended for use in health and safety decontamination of personnel, materials, and equipment that may become contaminated during field operations. Generally, the above-mentioned equipment will require additional decontamination after use for health and safety reasons.

8.5 References

Not used.

TITLE:

CHAIN OF CUSTODY

DATE: 07/91

REVISION NUMBER: 1

9.1 Scope

This procedure discusses methods for tracking the handling of samples through what is known as chain-of-custody (COC) procedures. The term "chain-of-custody" refers to a procedure of written documentation of sample acquisition, handling, and shipping of all samples potentially intended for enforcement or legal purposes. COC documents include the following information:

- Sampler identification;
- sample location;
- date and time collected; and
- individuals who handled the sample prior to its analysis at the laboratory.

Proper COC procedures play a crucial role in sample transfer. Validity of the samples with respect to enforcement matters depends on COC procedures that are well-documented and free of error. The most important aspect of the COC procedures is to have as few people as possible handle the sample to reduce the potential for mishap.

9.2 Definitions

Custodian: The person responsible for the custody of samples at a particular time, until custody is transferred to another person (and so documented), who then becomes the custodian. A sample is under your custody if:

- It is in your actual possession;
- it is in your view, after being in your physical possession;
- it was in your physical possession, and then you locked it up to prevent tampering; and
- it is in a designated and identified secure area.

Sample: A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the point and time that it was collected.

Chain-of-Custody Record Form: A Chain-of-Custody Record Form is a printed two-part form that accompanies a sample or group of samples as custody of the sample(s) is transferred from the custodian to the subsequent custodian.

9.3 Equipment and Materials

The following are materials required for chain of custody:

- Field logbook;
- indelible ink marker;
- COC form; and
- laboratory request sheet.

9.4 Procedures

COC procedures consist of several levels of documentation. This documentation serves as the legal record for tracking sample collection and transport. Once a sample is obtained, it must be maintained under COC procedures until it is in the custody of the analytical laboratory. The person(s) collecting the sample is (are) responsible for the custody of the sample until it is properly transferred or dispatched. Each sample will be labeled properly as discussed in SOP7 Enviromental Sample Preparation. The labeled sample may then be cross-referenced to the sample documentation.

The field logbook will serve as official documentation of sampling activities. Field log books are to be constructed of bound, water-resistant note paper, and records are to be kept in ink unless weather conditions (i.e., rain) dictate using a hard lead pencil. The following items are basic elements which will be recorded in the notebook:

- Sample description;
- sample source;
- sample number;
- time and date of collection;
- prevailing weather;
- sampling method;
- preservatives used, if any;
- sample container type;
- field measurements (pH, temperature, etc.); and
- sampler's identity.

Where practical, the information will be recorded in tabular form to allow for review.

A COC form shall be filled out either simultaneously with the notations in the logbook or shortly after sample collection is completed for the day or task. The information required on the COC form includes:

- Project number;
- project name;
- sampler's signature;
- sample number;
- sample medium;
- sample location;
- date and time of sample collection;
- description and quantity of sample containers;
- pertinent remarks regarding the samples; and
- sample custody information.

At the time of sample transfer, the custodian of the samples will sign the "Relinquished By" area of the form and record the date and time in the adjacent blocks. The sample recipient will also sign the form at this time under the "Received By" heading. This procedure will continue until the samples are received at the analyzing laboratory or sample repository.

If the samples are being shipped by common courier, the COC form will be received by the courier airbill number in lieu of a signature from a courier employee. In this event, the COC form will be packed in a cooler with the laboratory samples in a resealable plastic bag.

To complete chain-of-custody procedures for shipping, each sample cooler or container must be sealed with at least two custody seals that must be signed and dated by the shipper. The custody seal consists of an approximately 1 inch by 3 inch label with adhesive backing that is sealed over the container hinge. If broken during transit, the sample custody has been compromised, which indicates potential tampering during transit. If unbroken, the integrity of the samples is assumed to be maintained.

9.4.1 Laboratory Request Sheets

In addition to the COC form, some projects also require a Laboratory Request Sheet. This form lists all of the requested analyses for each sample and discusses in detail any specialized analytical methods or procedures. The form includes the sample number, date and time collected, and the target analytes. Transfer of possession is identical to the COC forms.

After the samples are analyzed, a copy of each completed form shall accompany the data transmittal from the analyzing laboratory. All completed COC forms shall be provided to the site quality control officer for review prior to insertion into the project file.

9.5 References

Not used.

CHAIN-OF-CUSTODY RECORD

PROJECT NO.:	PROJECT NAME:
SAMPLERS (PRINT):	SAMPLERS (SIGNATURE):

SAMPLE NO.	DATE	TIME	COMP	GRAB	SAMPLE TYPE	SAMPLE LOCATION	NO. OF CON-TAINERS								REMARKS

RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED FOR LABORATORY BY (SIGNATURE):	REMARKS:		

TITLE:

FIELD LOGBOOK

DATE: 07/91

REVISION NUMBER: 1

10.1 Scope

This section discusses proper documentation of all site activities with respect to the daily field logbook. Field logbooks are the primary source of documentation for all site activities. They serve as legal record of all occurrences during those activities.

10.2 Definitions

Not used.

10.3 Equipment and Materials

The following is required:

- Bound, numbered, waterproof field logbook; and
- indelible ink pen.

10.4 References

Field logbooks must be bound and should have numbered, water-resistant pages. All pertinent information regarding the site and sampling procedures must be documented.

Information recorded in the logbook should be noted with the date and time of entry. The following items should be included as logbook entries:

- Name and exact location of site;
- date and time of arrival and departure;
- affiliation of persons contacted;
- name of person keeping log;
- names of all persons on site;
- purpose of visit;
- all available information on site;
- description of sampling plan;

- sampling event description; including methodology, sample numbers and volumes, description of samples, date and time of sample collection, and name of collector; and

- prevailing weather conditions.

All information should be recorded in permanent ink for the legal record. The pages of the logbook should be numbered for ease of reference. At the end of each field day, the project scientist/engineer or his designee should sign and date the notebook to verify the day's activities.

10.5 References

Not used

TITLE:

SUBSURFACE SOIL SAMPLING

DATE: 07/91

REVISION NUMBER: 1

12.1 Scope

Soil sampling is an important component of a hydrogeologic investigation. Vadose zone sample analysis may indicate the presence of contaminants which have not reached the water table, but have the potential for future contamination of the groundwater. Soil type can typically vary across a study site and affect groundwater conditions. Therefore, it is important to maintain an accurate field record during sampling operations. Engineering and physical properties of soil may also be of interest should site construction activities be planned. The physical characteristics of soil which are of interest may include: soil type, bearing strength, compressibility, permeability, plasticity, and moisture content.

The scope of this procedure is to provide the methods and sequence of operations for subsurface soil sampling. The methods utilized are ASTM D1586-67, Method for Penetration Test and Split Barrel Sampling of Soils, and ASTM D1587-74, Thin-Walled Tube Sampling of Soils.

12.2 Definitions

Undisturbed Sample: A soil sample that has been obtained by methods in which precautions have been taken to minimize disturbance to the sample.

Water Table: A surface in an aquifer where groundwater pressure is equal to atmospheric pressure.

12.3 Equipment and Materials

The following equipment, usually provided by the drilling subcontractor, may be needed for subsurface soil sampling operations:

- Drilling rig/equipment;
- split barrel (split spoon) samplers, OD 2 inches; ID 1 3/8 inches; length 27 inches (open);
- thin-walled tubes (Shelby), OD 2 to 5 inches; length 36 to 54 inches;

- drive weight assembly, 140 lb weight, driving head and guide permitting 30 inch free fall; and

- sampling equipment including: labels, paraffin, stove, and sample jars (glass, 3 1/2 inch high, 2 inch ID), etc.

It is the site hydrogeologist's responsibility to ensure that all appropriate equipment is onsite prior to initiation of operations.

12.4 Procedures

Prior to initiating either sampling method, the following will apply:

- The hole will be advanced to the desired sampling depth using equipment that will ensure that the interval to be sampled is not disturbed;

- bottom discharge drill bits are not permitted, although side discharge drill bits may be utilized;

- jetting through an open-tube sampler during advance and then sampling at the desired depth is not permitted; and

- casing shall not be advanced below the sampling elevation.

12.4.1 Split Spoon Samplers

Split-spoon samplers consist of a heavy steel sampling tube which can be split into equal halves to reveal the soil sample. A drive head is threaded to the upper end, which in turn is threaded on the drill rod. A tapered nosepiece is threaded to the other end and facilitates advancement. A sample retainer may be inserted into the nosepiece which helps to prevent the loss of dry soil samples when the sampler is removed. The sampling procedure is as follows:

- Place the split spoon sampler, attached to the drill rod, on the bottom of the drill hole. Using a 140 lb hammer falling 30 inches, drive the sampler either 18 inches or until 100 blows have been reached.

- Record the number of blows required to drive the spoon each 6 inch interval. The first 6 inch interval driven is considered the seating drive. When the spoon is driven the entire 18 inch interval, the sum of the second and third 6 inch interval blow counts is considered the penetration resistance (N). When less than 18 inches is driven, the last 1 foot interval blow count sum is considered the penetration resistance. If less than 1 foot is penetrated, record the blow count and depth penetrated. This procedure is referred to as the Standard Penetration Test.

- Remove the sampler from the hole and detach from the drill rod. Remove the drive head and nosepiece and separate the split spoons, taking care not to shear or disturb the soil sample. A small portion at the top of the sample is usually disturbed and should be discarded. Place a representative sample of the undisturbed soil into sample jars without compacting the sample. To prevent the evaporation of soil moisture, the jars should be either hermetically sealed or sealed with wax, if soil moisture content is a concern.

- Affix to the jar an adhesive label containing the following information: boring number, sample number, date, depth penetration record, and length of recovery. The samples should be protected against extreme temperature conditions.

12.4.2 Thin-walled Seamless Tube Samplers

Thin-walled seamless tube samplers (Shelby tubes) are utilized to obtain undisturbed soil samples. Their use is somewhat restricted, depending upon the consistency of the soil to be sampled. Very loose and/or wet samples cannot be obtained by the sampler, and soils with a consistency in excess of medium stiff cannot be penetrated by the sampler. There are devices available to be used in conjunction with the tubes to aid in the recovery of these soils. Should the method prove inadequate in obtaining a sample, a split spoon should be utilized to obtain a sample for classification purposes.

The sampling procedure is as follows:

- Place the sampling tube on the bottom of the drill hole. Apply pressure on the tube, pushing the tube into the soil at a constant rate. Care should be taken not to allow impaction or twisting of the tube. Only allow the tube to penetrate to a depth equal to the length provided for the sample, allowing 3 inches for cuttings and sludge.

- Upon completion of penetration, allow the tube to remain in its position period of 5 to 15 minutes. This will allow equalization of pressure in the soil and adherence to the walls of the tube.

- Prior to removal of the tube, shear the sample by turning the tube 2 complete revolutions with a pipe wrench.

- Upon removal of the sampler tube, record the sample length and the length penetrated. Remove the disturbed soil in the upper end and record the final length. Remove approximately 1 inch of soil from the lower end. Insert an impervious disk, and seal both ends with wax. Care should be exercised so as not to allow the wax to enter the sample. Place newspaper or other suitable filter in the voids at either end of the sample. Secure plastic caps on both ends, tape them, and seal by dipping both ends in wax.

- Affix to the tube adhesive labels containing the following information: job designation, sample location, date, boring number, sample number depth, penetration, and recovery length. Using indelible ink, mark the same information on the tube and mark the location of the top of the sample.

- Store tubes upright in a cool place out of the sun. Do not allow the tubes to freeze. Samples should be surrounded with resilient packing material when shipped to reduce shock, vibration, and disturbance.

- A description of the soil removed from both ends of the tube should be recorded in the field log.

12.4.3 Data Collection

The data obtained during the sampling operations is recorded in the field logbook and should include the following:

- Name and location of site;

- date of boring (start and finish);

- boring number and coordinate, if available;
- surface elevation, if available;
- sample number and depth interval;
- type and size of sampler;
- method of advancing sampler; penetration and recovery lengths;
- drill rig type;
- soil description;
- layer thicknesses;
- depth to water, to loss of water, and to artesian head, including time of observation;
- casing size, depth of cased hole;
- blow count;
- names of crewmen; and
- weather, remarks.

12.5 References

Not used.

21.1 Scope

Field classification of soil and rock samples should be conducted in a rational and similar manner by each individual at a project site. This procedure provides a general guideline for the classification of soils and rocks encountered in the field using the Unified Soil Classification System (USCS).

21.2 Definitions

Not used.

21.3 Equipment and Materials

The following equipment and materials may be used for soil and rock classification:

- 6 foot folding ruler (engineers scale);
- clear plastic protractor;
- indelible marker;
- water squirt bottle;
- 10x hand lens;
- knife, penny; and
- pocket penetrometer.

21.4 Procedures

21.4.1 Soil Classification

Soils are to be classified according to the USCS. The USCS system identifies soil types based on grain size, liquid limits and plasticity indices. Four soil fractions are used: cobbles, gravel, sand, and fines (silt and clay). The boundaries between these fractions are given in Table SOP 21-1. The USCS divides soil into the following categories: coarse-grained; fine-grained; and highly organic soils. These categories are further subdivided according to the soils individual composition. The coarse grained soils are subdivided according to grain size fractions. The fine grained soils are subdivided according to their relative properties. Table SOP 21-2 illustrates the USCS system of classification. The table should be used from left to right, categorizing the soil by process of elimination until a name is obtained. When categorizing a soil, the standard name should be used followed by the group symbol.

Coarse grained soil classification should be divided into rock fragments and sand, gravel or cobbles. The terms sand, gravel, and cobble refer to the size of the soil particles, as well as their depositional history. The term rock fragment should be used when referring to granular materials resulting from the break up of rock. These fragments are normally angular, indicating little or no transport from their source. The term also provides additional information in reconstructing the depositional environment of the soils encountered. When the term rock fragment is used it should be followed by a size designation such as "(1/4 phi - 1/2 phi)" or "coarse-sand size" either immediately after the entry or in the remarks column.

Soils should be described utilizing the following Hierarchy:

- Density and/or consistency;
- color;
- plasticity (optional);
- soil type;
- moisture content;
- stratification;
- texture, fabric, bedding; and
- other distinguishing features.

The above mentioned terms identify the major characteristics of soils. The definitions and procedures are explained below.

Relative Density and/or Consistency

To classify the relative density and/or consistency of a soil, the geologist is to first identify the soil type. Granular soils contain predominantly sands and gravels. They are noncohesive (particles do not adhere well when compressed). Finer grained soils (silts and clays) are generally cohesive (particles will adhere together when compressed).

The compactness of noncohesive, granular soils is classified according to standard penetration resistances obtained from split spoon sampling methods.

Standard penetration resistance is the number of blows required to drive a split-barrel sampler with a 2-inch outside diameter 12 inch into the material using a 140-lb hammer falling freely through 30 inch. The sampler is driven through an 18-inch sample interval, and the number of blows is recorded for each 6-inch increment. The compactness designation of granular soils is obtained by adding the number of blows required to penetrate the last 12 inch of each sample interval. It is important to note that if gravel or rock fragments are broken by the sampler or if rock fragments are lodged in the tip, the resulting blow count will be erroneously high, reflecting a higher compactness than actually exists. Blow counts should be recorded in the boring log adjacent to the sample description.

The consistency of cohesive soils is determined by utilizing either standard penetration tests, a pocket penetrometer, or by determining the resistance to penetration by the thumb. The pocket penetrometer and thumb determination methods should be conducted on the lowest 0.5 feet of sample obtained in a split-barrel sampler. The sample should be broken in half and the thumb or pentrometer pushed into the end of the sample to determine the consistency. Do not determine consistency by attempting to penetrate a rock fragment. If the sample is decomposed rock, it is classified as a soft decomposed rock rather than a hard soil. Consistency should not be determined solely by blow counts. One of the other methods should be used in conjunction with it. Table SOP 21-3 illustrates the consistency designation parameters for the methods described above.

Dilatancy (Reaction to Shaking)

Remove particles larger than No. 40 sieve size from the sample and moisten a soil volume of approximately 1/2 cubic inch. Add enough water if necessary to make the soil soft but not sticky. Place the soil in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consists of the appearance of water in the surface of the pat which changes to a livery consistency and becomes glassy. When the sample is squeezed between the fingers, the water and glassy look disappear from the surface, the pat stiffens, and finally it cracks or crumbles. The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the fines in a soil.

Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction. Inorganic silts, such as a typical rock flour, show a moderately quick reaction.

Color

A single color descriptor should be utilized when describing soils. If necessary, a modifier may be used to denote variations in shade or color combinations. Examples of this include: gray, light gray, or blue-gray. Color descriptors should be consistent through the field operation. When describing colors, the sample should be broken or split vertically while still moist. Care should be taken not to smear the sample surface creating color variations between the sample interior and exterior.

Dry Strength (Crushing Characteristics)

Remove particles larger than No. 40 sieve size and mold approximately 1/2 cubic inch of soil to the consistency of putty, adding water if necessary. Dry the soil completely utilizing an oven, the sun, or air drying. Test the dried soils strength by breaking and crumbling between the fingers. This strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity.

High dry strength is characteristic for clays of the CH group. A typical inorganic silt possesses only very slight dry strength. Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

Toughness (Consistency Near Plastic Limit)

Remove particles larger than No. 40 sieve size from the soil sample. Mold approximately 1/2 cubic inches of soil to a consistency of putty, adding water if necessary. If the soil is too sticky, spread the sample in a thin layer and allow it to lose some moisture by evaporation. Roll the sample out by hand on a smooth surface or between the palms into a thread approximately 1/8 inch in diameter.

The thread is then folded and rerolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached.

After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles.

The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil. Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic clay of low plasticity, or materials such as kaolin-type clays and organic clays which occur below the A-line.

Highly organic clays have a very weak and spongy feel at the plastic limit.

Soil Descriptions

Soils are comprised of particles of varying size and shape, and may contain combinations of the various soil types. The following terms should be used when describing soil composition:

Terms Identifying Proportion of the Component	Defining Range of Percentages by Weight
Trace	0 - 10%
Some	11 - 30%
And or adjective form of the soil type (e.g., "sandy")	31 - 50%

Examples:

1. Silty fine sand: 50 to 69 percent fine sand, 31 to 50 percent silt.

2. Medium to coarse sand, some silt: 70 to 80 percent medium to coarse sand, 11 to 30 percent silt.

3. Fine sandy silt, trace clay: 50 to 68 percent silt, 31 to 49 percent fine sand, 1 to 10 percent clay.

4. Clayey, silt, some coarse sand: 70 to 89 percent clayey silt, 11 to 30 percent coarse sand.

Moisture

Moisture content is estimated in the field is divided into four categories: dry, moist, wet, and saturated. Dry soil contains little or no water. Saturated soil contains the maximum amount of water that can be held. Moist and wet classifications are somewhat subjective and often are determined by the individual's judgment. A suggested parameter for this would be calling a soil wet if rolling it in the hand or on a porous surface liberates water, i.e., dirties or muddies the surface. Whatever method is adopted for describing moisture, it is important that the method used by an individual remains consistent throughout an entire drilling job.

Laboratory tests for water content should be performed if the natural water content is important.

Stratification

Stratification or bedding thickness of soil and rock is dependent on grain size and composition. Stratification can only be determined after the sample barrel has been opened. Table SOP 21-4 illustrates the classification for the stratification description.

Texture/Fabric/Bedding

Texture is the relative angularity of the particle encountered. The descriptions are: rounded, subrounded, subangular, and angular. Fabric is the spatial and geometric configuration of the components that make up a soil or rock. Fabric should be noted as to whether the particles are flat or bulky and whether there is a particular relation between particles (i.e., all the flat particles are parallel or there is some cementation). The bedding or structure should also be noted (e.g., stratified, lensed, nonstratified, heterogeneous, varved).

21.4.2 Rock Classification

Rock classification is divided into three groups: sedimentary, igneous, and metamorphic. Sedimentary rocks are the most predominant rock type exposed at the earth's surface. The following basic terms are applied to sedimentary rocks:

- Sandstone - Made up predominantly of granular materials ranging between 1/16 and 2 inch in diameter.
- Siltstone - Made up of granular materials less than 1/16 inch in diameter. Fractures irregularly. Medium thick to thick bedded.
- Claystone - Very fine grained rock made up of clay and silt-size materials. Fractures irregularly. Very smooth to touch. Generally has irregularly spaced pitting on surface of drilled cores.
- Shale - A fissile very fine grained rock. Fractures along bedding planes.

- Limestone - Rock made up predominantly of calcite ($CaCO_3$). Effervesces upon the application of hydrochloric acid.

- Coal - Rock consisting mainly of organic remains.

- Others - Numerous other rock types are present in the geologic section. Their overall abundance is dependent upon the geographical locations. These include halite, gypsum, dolomite, anhydride, lignite, etc.

The following hierarchy should be utilized when classifying sedimentary rocks:

- Rock type;
- color;
- bedding thickness;
- hardness;
- fracturing;
- weathering; and
- other characteristics.

The above mentioned terms identify the major characteristics of rocks. These terms are described below.

<u>Rock Type</u>

Sedimentary rocks are resultant of the consolidation of sediment, and thus are often a combination of several sediment types. Because of this, modifiers should be used in the rock classification, when applicable. The modifier indicates that a significant portion of the rock is composed of the modifier. Examples of modifiers include: sandy siltstone, silty sandstone, carbonaceous, calcareous, siliceous, etc.

Grain diameters are used in the classification of sedimentary rocks. The Udden-Wentworth grain size classification will be utilized and is illustrated in Table SOP 21-5. A scale can be used in the field to determine the grain size of coarse grained rocks. The division between very fine sand and silt is not measurable in the field. The boundary should be determined by use of a hand lens. If the grains cannot be seen with the naked eye but are distinguishable with a hand lens, the rock is a siltstone. If the grains are not distinguishable with a hand lens, the rock is a claystone.

Color

Rock color classification should be performed similar to soil color classification. Rock core samples should be classified when wet, if possible, and samples should be scraped clean of cuttings prior to classification.

Bedding Thickness

Bedding thickness classification shall be the same as that used in the soil bedding thickness classification.

Hardness

Hardness is a function of the compaction, cementation, and mineralogical composition of the sedimentary rock. A relative hardness scale for sedimentary rocks is as follows:

- Soft - Weathered, considerable erosion of core, easily gouged by screwdriver, scratched by fingernail. Soft rock crushes or deforms under pressure of a pressed hammer. This term is always used for the hardness of the saprolite (decomposed rock which occupies the zone between the lowest soil horizon and firm bedrock);
- Medium soft - Slight erosion of core, slightly gouged by screwdriver, or breaks with crumbly edges from single hammer blow;
- Medium hard - No core erosion, easily scratched by screwdriver, or breaks with sharp edges from single hammer blow; and
- Hard - Requires several hammer blows to break and has sharp conchoidal breaks. Cannot be scratched with screwdriver.

Note the difference in usage here of the words "scratch" and "gouge". A scratch should be considered a slight depression in the rock (do not mistake the scraping off of rock flour from drilling with a scratch in the rock itself), while a gouge is much deeper.

Fracturing

The degree of fracturing of a rock is determined by measuring the fractures or joint spacing. The procedure for determining the degree of fracturing is to calculate the average spacing of the fractures or joints. The breaks created during the drilling process should not be considered in this process. The following terms should be utilized:

- Very broken (V. BR.) - Less than 2 inches
- Broken (BR.) - 2 inches to 1 foot
- Blocky (BL.) - 1 to 3 feet
- Massive (M.) - 3 to 10 feet

The structural integrity of the rock can be approximated by calculating the Rock Quality Designation (RQD) of cores recovered. The RQD (Deere, 1964) is determined by adding the total lengths of all pieces exceeding 4 inches and dividing by the total length of the coring run, to obtain a percentage.

$$RQD = r/l \times 100$$

where:

r = Total length of all pieces of the lithologic unit being measured, which are greater than 4 inches length, and have resulted from natural breaks. Natural breaks include slickensides, joints, compaction slicks, bedding plane partings (not caused by drilling), friable zones, etc.

l = Total length of the coring run.

Weathering

The degree of weathering is utilized in determining weathering profiles, and used in engineering designs. The following terms should be utilized when classifying the degree of weathering:

- **Fresh - Rock shows little or no weathering effect. Fractures or joints have little or no staining and rock has a bright appearance;**

- **Slight - Rock has some staining which may penetrate several centimeters into the rock. Clay filling of joints may occur. Feldspar grains may show some alteration;**

- Moderate - Most of the rock, with exception of quartz grains, is stained. Rock is weakened due to weathering and can be easily broken with hammer; and

- Severe - All rock including quartz grains is stained. Some of the rock is weathered to the extent of becoming a soil. Rock is very weak.

Other Characteristics

The following information should be included in the rock description where applicable:

- Description of contacts between two rock units. These can be sharp or gradational;

- description of any filled cavities or vugs;

- description of any joints or open fractures; and

- notation of joints with depth, approximate angle to vertical, any mineral filling or coating, and degree of weathering.

Additional information should be provided on the log, such as:

- Type of cement;
- degree of cementation;
- texture of the rock (relationship of component particles or crystals); and
- structure or megascopic features.

Generally, rock structure is best seen in the outcrop rather than the hand specimen, but some indications of structure (e.g., horizontal or dipping beds, open joints) can be obtained from core samples. An estimate of primary permeability (rock matrix) and secondary permeability (joint) should be made as an addition to the log.

Additional Terms

The following terms are useful in further identification of rocks:

- Seam - Thin (12 inches or less), probably continuous layer.

- Some - Indicates significant (15 to 40 percent) amounts of the accessory material. For example, rock composed of seams of sandstone (70 percent) and shale (30 percent) would be "sandstone -- some shale seams."

- Few - Indicates insignificant (0 to 15 percent) amounts of the accessory material. For example, rock composed of seams of sandstone (90 percent) and shale (10 percent) would be "sandstone -- few shale seams."

- Interbedded - Used to indicate thin or very thin alternating seams of material occurring in approximately equal amounts. For example, rock composed of seams of sandstone (50 percent) and shale (50 percent) would be "interbedded sandstone and shale."

- Interlayered - Used to indicate thick alternating seams of material occurring in approximately equal amounts.

21.4.3 Abbreviations

The use of abbreviations is permitted in the description of rocks and soils. Their use should be kept to a minimum. The following are some of the abbreviations that may be used:

C	-	Coarse	BR	-	Broken
Med	-	Medium	BL	-	Blocky
F	-	Fine	M	-	Massive
V	-	Very	Br	-	Brown
SL	-	Slight	GN	-	Green
Sm	-	Some	Gr	-	Gray
Occ	-	Occasional	Bl	-	Black
Tr	-	Trace	Yl	-	Yellow
Lt	-	Light	Or	-	Orange
Dk	-	Dark	Rd	-	Red

21.4.4 Data Collection

Additional information about the study area should be noted by the site geologist/engineer. Rock outcrops can provide information on lithology, stratigraphy, structure, and degree and orientation of fracturing. Examining the geomorphological features of an area can provide additional insight into the geology of the area. Exposed soils can provide information on the origin of the soils (residual, alluvial, etc.) and help in defining the area's geology. This information should be obtained whenever possible and recorded in the field logbook. Important features of the study area should be noted on a site map in the field.

21.5 References

Not used.

TABLE SOP 21-1

USCS GRAIN SIZE CLASSIFICATION FOR SOILS

Particle Name	Grain Size Diameter
Cobbles	> 80 MM
Coarse Gravel	20 - 80 MM
Fine Gravel	5 - 20 MM
Coarse Sand	2 - 5 MM
Medium Sand	0.4 - 2 MM
Fine Sand	0.08 - 0.4 MM
Fines (silt or clay)	< 0.08 MM

TABLE SOP 21 - 2

SOIL TERMS
UNIFIED SOIL CLASSIFICATION (USCS)

COARSE GRAINED SOILS

More than half of material is LARGER than No. 200 sieve size

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 3" & basing fractions on estimated weights)			GROUP SYMBOLS	TYPICAL NAMES
GRAVELS 50% (+) > 1/4" ø	CLEAN GRAVELS Low % fines	Wide range in grain size and substantial amounts of all intermediate particle sizes	GW	Well graded gravels, gravel-sand mixtures, little or no fines
		Predominantly one size or a range of sizes with some intermediate sizes missing	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
	GRAVELS W/FINES High % fines	Non-plastic fines (for identification procedures see ML)	GM	Silty gravels, poorly graded gravel-sand silt mixtures
		Plastic fines (for identification procedures see CL)	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
SANDS 50% (+) < 1/4" ø	CLEAN SANDS Low % fines	Wide range in grain size and substantial amounts of all intermediate particle sizes	SW	Well graded sand, gravelly sands, little or no fines
		Predominantly one size or a range of sizes with some intermediate sizes missing	SP	Poorly graded sands, gravelly sands, little or no fines
	SANDS W/FINES High % fines	Non-plastic fines (for identification procedures see ML)	SM	Silty sands, poorly graded sand-silt mixtures
		Plastic fines (for identification procedures see CL)	SC	Clayey sands, poorly graded sand-clay mixtures

FINE GRAINED SOILS

More than half of material is LARGER than No. 200 sieve size

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 3" & basing fractions on estimated weights)				GROUP SYMBOLS	TYPICAL NAMES
Identification procedures on fraction smaller than No. 40 sieve size					
	DRY STRENGTH (Crushing Characteristics)	DILATANCY (Reaction to Shaking)	TOUGHNESS (Consistency Near Plastic Limit)		
SILTS & CLAYS Liquid limit < 50	None to slight	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
	Medium to high	None to very slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	Slight to medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity
SILTS & CLAYS Liquid limit > 50	Slight to medium	Slow to none	Slight to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	High to very high	None	High	CH	Inorganic clays of high plasticity, fat clays
	Medium to high	None to very slow	Slight to medium	OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS	Readily identified by color, odor, spongy feel and frequently by fibrous texture			PT	Peat and other organic soils

TABLE SOP 21-3

CONSISTENCY OF COHESIVE SOILS

Consistency Designation	Blows per Foot	Unconfined Compressive Strength (tons per square foot by pocket penetration)	Field Identification
Very soft	0 to 2	Less than 0.25	Easily penetrated several inches by fist.
Soft	2 to 4	0.25 to 0.50	Easily penetrated several inches by thumb.
Medium Stiff	4 to 8	0.50 to 1.0	Can be penetrated several inches by thumb with moderate effort.
Stiff	8 to 15	1.0 to 2.0	Readily indented by thumb but penetrated only with great effort.
Very Stiff	15 to 30	2.0 to 4.0	Readily indented by thumbnail.
Hard	Over 30	More than 4.0	Indented by thumbnail.

TABLE SOP 21-4

BEDDING THICKNESS CLASSIFICATION

Thickness (Metric)	Thickness (Approximate English Equivalent)	Classification
>1.0 meter	>3.3 feet	Massive
30 cm - 1 meter	1.0 ft - 3.3 ft	Thick Bedded
10 cm - 30 cm	4 in - 1.0 ft	Medium Bedded
3 cm - 10 cm	1 in - 4 in	Thin Bedded
1 cm - 3 cm	2/5 in - 1 in	Very Thin Bedded
3 mm - 1 cm	1/8 in - 2/5 in	Laminated
1 mm - 3 mm	1/32 in - 1/8 in	Thinly Laminated
<1 mm	<1/32 in	Micro Laminated

Weir, 1973 and Ingram, 1954

TABLE SOP 21-5

GRAIN SIZE CLASSIFICATION FOR ROCKS

Particle Name	Grain Size Diameter
Cobbles	>64 mm
Pebbles	4 - 64 mm
Granules	2 - 4 mm
Very Coarse Sand	1 - 2 mm
Coarse Sand	0.5 - 1 mm
Medium Sand	0.25 - 0.5 mm
Fine Sand	0.125 - 0.25 mm
Very Fine Sand	0.0625 - 0.125 mm
Silt	0.0039 - 0.0625 mm

After Wentworth, 1922

AWD TECHNOLOGIES

TEST BORING ______

PAGE OF

PROJECT NAME ______ PROJECT NO. ______

LOCATION ______ GEOLOGIST ______

BY ______ DRILLING CONTRACTOR ______ DRILLER ______

DATE ______ DRILLING METHOD ______ RIG TYPE ______

CHK BY ______ DRILLING START DATE ______ DRILLING COMPLETION DATE ______

DATE ______ SURFACE ELEVATION ______ STICK-UP ELEVATION ______

DEPTH FEET	SOIL SAMPLE NO.	REC. (IN.)	BL/6"	VISUAL CLASSIFICATION AND REMARKS	PROFILE	STATIC WATER LEVEL (FT)	OVA READING	DEPTH (FEET)	REMARKS

ADDITIONAL REMARKS

TITLE:

HEADSPACE ANALYSIS FOR SOILS

DATE: 07/91

REVISION NUMBER: 1

25.1 Scope

The use of headspace analysis as a non-gas chromatograph (non-GC) field screening technique provides for the qualitative analysis of volatile compounds in soils by use of a portable or transportable instrument based at, or near, a sampling site. Field screening generates Level I data. As such, field screening provides unique information, and it is therefore important to understand the usability of the data generated. Despite the sophistication of the instruments used, non-GC field screening should not be confused with specific techniques which have the ability to identify specific compounds.

The main asset of headspace analysis for field screening lies in quick turn-around time for support in field decisions involving, for example, the best placement of well screens, the direction of samples to fixed laboratories for complete analysis, the optimal position of monitoring wells, the delineation of contaminant plumes, evaluation of the possibility of unexpected exposure to field personnel, and fundamental regulatory/remedial support. In this manner, field screening allows for decisions to be made on a real time basis while the field team is mobilized, thus avoiding the lag time that occurs while awaiting fixed-based laboratory results.

Field screening by headspace analysis techniques are applicable to the analysis of air, soil gas, water and solid matrices primarily for various volatile and semi-volatile compounds. The procedures outlined below pertain to headspace analysis of soil samples. For correlative and quality control purposes, field screening of this type is usually done in conjunction with submission of a predetermined percentage of samples to a fixed based laboratory for split sample analysis.

25.2 Definitions

Not used.

25.3 Equipment and Materials

The following equipment and materials may be required:

- Organic Vapor Analyzer (OVA),
  Flame Ionization Detector, or
  Photoionization Detector;

- OVA repair kit, spare parts, minimum of 6 probes;

- calibration gas standard (100 ppm);

- organic free bottled air;

- analysis logbook with site diagram;

- plastic Ziploc bags, 1 gallon capacity; and

- self-stick paper labels, preprinted.

25.4 Procedures

The vapor headspace generated from soil samples collected during the course of a field investigation may be evaluated in real-time to guide further activities. Soil samples may be collected by hand or power auguring, drilling with split spoon or shelby tube techniques, or simply by grab sampling with a hand trowel. Regardless of the method of sample collection, it is very important to disturb the soil as little as possible prior to it's collection.

It is also important to contain the sample as quickly as possible, to insure that any volatiles which may be present in the matrix are prevented from dissipating prior to analysis. Because the goal of this screening is the non-selective qualification of volatile organics, an organic vapor analyzer (OVA) will be used. Prior to analysis, equilibration of the sample temperature must be achieved to insure detection of volatiles within the soil. This means that in colder weather steps must be taken to provide an environment, for example a field trailer or automobile, that can produce an ambient temperature of at least 60 degrees F. Soil samples may be analyzed 5 to 10 minutes after collection in warmer weather, or, all samples may be removed from the field to a controlled area and analyzed at the end of each day or shift.

25.4.1 Analysis

The following procedures shall be followed for the evaluation of vapor headspace from site soil samples:

- Sample recovery. In general, two people will be required to collect and contain soil samples. One person will stand by, ready with the appropriate container for the sample for laboratory analysis (if necessary) and with the plastic bag for headspace. The bag must be sealed immediately after sample deposition.

- Sample log-in. An analyst will transcribe applicable field log information into a field logbook. This will include sample ID, location, time, initials of sampler, depth of sample, condition of sample, etc..

- The OVA shall be calibrated according to manufacturers specifications. The calibration event will be logged on the appropriate field forms and logbook.

- (Warm Weather) The sample will be allowed to equilibrate for 5 to 10 minutes inside the sealed bag. If the matrix is bound together in clumps they may be broken up by hand from outside the bag. Or,

  (Cold Weather) The sample may be warmed up at the sampling site by using a sample bath or small sample oven. Preferably, the samples will be collected and removed to a heated controlled environment such as a trailer, or automobile, where they can equilibrate. It is important that the entire sample reach at least 60° F prior to analysis.

- Carefully insert the OVA probe through a small opening in the Ziploc seal of the bag, gently pinching contact between the probe and the bag to maintain a seal. Care should be taken to insure that the probe touch only the headspace above the soil - and not the soil matrix itself.

- (Analog) Observe the deflection in the OVA needle for 10 to 15 seconds and record the findings in the analysis logbook. Or,

  (Digital) Observe the readout until equilibrium is established. This should take 5 to 10 seconds. Record findings in the analysis logbook.

- Transmit results in tabular form to the field supervisor for incorporation into the overall field logbook.

25.4.2 Quality Assurance / Quality Control

OVA survey mode field screening data is semi-qualitative, non-specifically quantitative, yet can be representative of site conditions. In order to assure a reasonable level of precision, accuracy and representativeness of the data generated by these sampling and analysis efforts, the following QA/QC protocols shall be followed:

Quality Assurance

- The sampling and analysis specialist shall be adequately familiarized through experience and training in the sampling methods employed;
- analysts shall be experienced in the start-up, calibration, operation and maintenance of the OVA;
- all personnel coming into contact with potentially hazardous materials shall be trained and certified in the handling of those wastes; and
- site sampling and analysis procedures, protocols and methods shall be audited, reviewed and evaluated under the direction of the Project Manager or the Corporate QA Officer routinely.

Quality Control

- Field duplicates shall be taken to assess the representativeness of the sampling technique and homogeneity of the waste distribution in soils;
- OVA calibration shall be checked at the beginning and end of each analysis day or shift. The manufacturers specifications will be followed exactly, using the appropriate standard gas and reading correction factors for standard and background; and
- laboratory blanks (organic free bottled air) shall be used to "clear" the OVA after each positive sample.

25.5 References

Not used.

I. PURPOSE:

The purpose of this procedure is to establish the requirements necessary to help ensure that AWD complies with applicable United States Department of Transportation regulations covering shipment of hazardous materials.

II. SCOPE AND APPLICATION:

This procedure applies to all AWD employees who may package, label, transport, receive, or offer for transport any regulated hazardous material that is subject to the requirements of 49 CFR, and to all AWD employees who may assist in such activities.

III. DEFINITIONS:

The definitions contained in this section are for purposes of clarifying some of the terms used in this procedure and should not be used as definitions of terms used elsewhere.

Carrier shall mean any individual or company (Federal Express, United Parcel Service, Airborne Express, AWD vehicle, etc.) who transports hazardous materials for the shipper.

Regulated Hazardous Material shall mean any chemical, substance, material, sample, article, equipment, etc. that is specifically identified by the Hazardous Material Tables in 49 CFR 172.101, the appendix to 49 CFR 172.101, or which meets the definition of any one of the hazard classes defined by 49 CFR 173 Subpart C (explosives); Subpart D (flammable gas, non-flammable compressed gas, poisonous gas, flammable liquid, flammable solid, spontaneously combustible material, dangerous when wet material, oxidizers, organic peroxides, poisonous material, infectious substances, corrosives, and miscellaneous hazardous materials) or Subpart I (radioactive materials).

Hazardous Shipment shall mean a package containing one or more regulated hazardous materials subject to the packaging, labeling, marking, and/or shipping paper requirements of 49 CFR.

- **Hazmat Shipping Specialist** shall mean an AWD employee appointed by an AWD Office Manager, AWD Regional Manager, or an AWD Project Manager to provide knowledgeable assistance in the application of the requirement of 49 CFR.

Receiver shall mean the AWD employee who receives a regulated hazardous materials shipment.

Shipper shall mean the AWD employee who prepares a regulated hazardous material package for shipment and/or who offers such packages to a carrier for shipment.

Environmental Sample shall mean a sample of surface water, groundwater, soil, or air which does not contain free-phase product or exhibit any characteristics of a DOT hazard class.

IV. RESPONSIBILITIES

The responsibilities defined in this section are in addition to those defined elsewhere in this procedure.

A. Shippers and Receivers

It is the responsibility of each shipper or receiver to ensure the requirements of this procedure and the AWD Guidance Manual for Shipping Hazardous Materials and Environmental Samples are followed. Additionally, each shipper shall notify the Office Hazmat Shipping Specialist (HSS) prior to the first-time shipment of any potentially regulated hazardous material.

B. Hazmat Shipping Specialists

It is the responsibility of each Hazmat Shipping Specialist to assist the Regional/Office/Project Manager in identifying and properly training all individuals under their control who may prepare, ship, or receive regulated hazardous material shipments.

It is the responsibility of each HSS to assist shippers in classifying potentially regulated hazardous materials and to assist shippers in the interpretation of all applicable guidelines and regulations.

The Office HSS shall ensure that current copies of the AWD "Guidance Manual for Shipping Hazardous Materials and Environmental Samples," 49 CFR 100-199, International Air Transportation Association "Dangerous Goods Regulations," DOT "Emergency Response Guidebook," and AWD SOP HS3.2 are available in their respective offices.

It is the responsibility of each Hazmat Shipping Specialist to inform the Corporate Health and Safety Manager of any known deficiencies in the implementation of this procedure.

C. **Regional/Office/Project Managers**

It is the responsibility of each Regional, Office, and Project Manager to ensure all regulated hazardous material shipments are done in accordance with 49 CFR, the AWD Guidance Manual on Shipping Hazardous Materials, and this SOP.

Each Regional, Office, and Project Manager shall appoint a Hazmat Shipping Specialist, as needed, to ensure that regulated hazardous materials are properly shipped.

It is also the responsibility of each Regional/Office/Project Manager to ensure that the appointed person/persons obtains any specialized training necessary to fulfill the requirements of this procedure.

D. **Corporate Health and Safety Manager**

It is the responsibility of the Corporate Health and Safety Manager (CHSM) to monitor compliance with this procedure and to coordinate interactions between AWD and Dow regarding the 24-hour Emergency Information Service telephone number.

V. GENERAL REQUIREMENTS:

A. Hazardous Material Determinations

The shipper shall determine if the shipment is a hazardous shipment. If there is any question as to whether or not the shipment is hazardous, the shipper shall seek the advise of an AWD Hazmat Shipping Specialist.

B. Preparing Hazardous Materials Shipments

Whenever regulated hazardous materials are being prepared for shipment, the shipper shall follow the instructions contained in the AWD Guidance Manual for Shipping Hazardous Materials and Environmental Samples. Whenever a regulated hazardous material being shipped is not specifically addressed in the guidance manual, the shipper shall seek written instruction from an AWD Hazmat Shipping Specialist.

> Important Note: Obtaining written instruction for special or non-routine hazardous materials shipments can take several days, depending on the availability of the CHSM and AWD's contact at Dow, and depending on AWD's ability to secure a 24-hour Emergency Information Service telephone number.

C. Offering Regulated Hazardous Materials For Shipment

The shipper shall offer for shipment only those regulated hazardous materials that have been prepared for shipment in accordance with the written instructions provided in the AWD Guidance Manual for Shipping Hazardous Materials and Environmental Samples or by an AWD Hazmat Shipping Specialist.

1. If the carrier refuses to accept the shipment as prepared, the shipper shall contact an AWD Hazmat Shipping Specialist for information on how to correct the deficiencies identified by the carrier. The Hazmat Shipping Specialist shall inform the CHSM of the discrepancies between AWD's instructions and the carrier's comments. If addressing the carrier's comments is believed to reduce the level of

safety associated with the shipping process, the shipper shall retain possession of the package and shall contact the CHSM.

2. When shipping regulated hazardous materials, a copy of the shipping papers must be retained, by the shipper, for at least the current year plus 5 years. This records retention practice should be accomplished through the official project and/or office file.

D. Accepting Hazardous Shipments

Hazardous shipments shall only be received by properly trained individuals. Immediately upon receipt of a hazardous shipment, the receiver shall verify the integrity of the package and shall read the shipping papers and the labels on the package.

1. Regulated hazardous material shipments shall not be accepted whenever there is reason to believe that the inner packaging has failed to protect the material being shipped. If this situation arises, the receiver shall immediately notify the HSS and/or the RHSM.

Hazardous shipments received by AWD shall be handled according to the hazard information presented on the shipping papers and on the labels. Such shipments shall be immediately secured/stored in an appropriate area in a manner that does not jeopardize the integrity of the packaging or the safety of AWD employees or the public.

E. Preparing Environmental Samples for Shipment

Whenever environmental samples are being prepared for shipment, the shipper shall follow the instructions contained in the AWD Guidance Manual for Shipping Hazardous Materials and Environmental Samples. Any deviation from these instructions must be approved by the RHSM. Attachment 3.2-1 is a reproduction of the current instructions referenced above.

VI. SPECIAL REQUIREMENTS FOR HAZMAT SHIPPING SPECIALISTS:

A. Identifying Hazardous Shipments

Whenever a Hazmat Shipping Specialist has been asked to determine if a shipment is a hazardous shipment, the individual shall:

1. Identify any chemical, substance, product, material, waste, instrument, item, mixture, or article associated with the item being shipped that is either forbidden, explosive, flammable, compressed, reactive, oxidizing, poisonous, infectious, radioactive, corrosive, and/or otherwise hazardous as defined in 49 CFR 173.2. Assistance can be obtained from the manufacturer of the item and/or from material safety data sheets, operations manuals, technical specifications, etc., if available.

2. Identify the proper shipping name and hazard class of the hazardous material(s) by using the Hazardous Materials Shipping Tables found in 49 CFR 172.101, in accordance with 49 CFR 172.101(c).

3. Determine if the hazardous material is to be shipped in quantities that exceed the exemptions for small quantities found in 49 CFR 173.4.

4. Determine the nature and extent of any exceptions listed in Column 8(a) of the Hazardous Materials Shipping Tables.

5. Determine the appropriate packaging requirements listed in Columns 8(b) or 8(c).

If the Hazmat Shipping Specialist is uncertain of any determination to be made above, additional assistance shall be obtained by contacting another Specialist or by contacting the CHSM.

B. Preparing Special or Non-Routine Shipments

Whenever a regulated hazardous material to be shipped is not specifically addressed by the AWD Guidance Manual for Shipping Hazardous Materials and Environmental Samples, an AWD Hazmat Shipping Specialist shall prepare written shipping instructions similar to those found in the AWD Guidance Manual. In addition, the Specialist shall prepare an Emergency Response Guideline that complies with 49 CFR 172.602. The Specialist shall then send or fax this information to the CHSM, or his designee, for review and approval. Once the shipping instructions have been approved, the Specialist can provide the written instructions to the shipper and the item can be prepared/shipped accordingly.

C. Emergency Response Information

Emergency response information must be readily available on a 24-hour basis for all regulated hazardous materials shipments. Such information shall comply with the requirements of 49 CFR 172.602.

Emergency response information for the materials addressed in the AWD Guidance Manual can be obtained from any Hazmat Shipping Specialist. This information has been provided to the Dow 24-hour Emergency Information Service. Additionally, Dow has been provided a list of contacts within AWD in the event additional information regarding a particular material being shipped is needed.

For all special or non-routine hazardous shipments, sent by AWD, the CHSM shall submit the shipping instructions along with an Emergency Response Guideline to The Dow Chemical Company for incorporation into the 24-hour Emergency Information Service prior to approving any shipping instruction prepared and submitted under Section VI. C., above. Alternatively, the CHSM may choose to make special arrangements for another form of 24-hour Emergency Information Service (e.g., cellular phone), providing the service is available at all times while the carrier is in possession of the hazardous material.

VII. TRAINING AND INFORMATION:

A. Awareness Training

All AWD employees covered by this procedure will be provided with Awareness Training. At a minimum, this training will consist of the following:

1. A brief introduction to hazardous materials shipping and handling including the basic requirements of 49 CFR 171 through 173.
2. A statement that the preparation, shipping, and receiving of hazardous materials must only be performed by trained and authorized employees.
3. A brief overview of the AWD Guidance Manual for Shipping Hazardous Materials.

B. Safety Training

All AWD personnel who may prepare or ship regulated hazardous materials must have successfully completed the OSHA 40-hour training and applicable hazard communication training.

C. Function-Specific Training

All AWD personnel who may prepare or ship regulated hazardous materials will be provided with the training necessary to ensure compliance with 49 CFR 172.704(a)(2). This training, in addition to awareness-level training, will occur prior to requiring an employee to fulfill the responsibilities of a shipper and will be updated at a frequency of at least every 2 years. This training will include, as a minimum, the following:

1. An in-depth review of the AWD Guidance Manual for Shipping Hazardous Materials and Environmental Samples, along with any subsequent updates or additions to the manual, and any written shipping instructions prepared independently of the manual.
2. A review of hazard warning labels and corresponding safe handling practices to help ensure regulated hazardous materials are properly handled upon receipt.

D. Hazmat Shipping Specialist Training

All AWD Hazmat Shipping Specialists will be provided with training in the proper utilization of 49 CFR and will be required to demonstrate a working knowledge of this information prior to being assigned the related responsibilities. This training may be received from an AWD Vendor, another AWD Hazmat Shipping Specialist, or can be self-taught by reviewing the regulations in detail.

ATTACHMENT 3.2-1

SECTION 3.9 OF THE AWD GUIDANCE MANUAL FOR SHIPPING HAZARDOUS MATERIALS AND ENVIRONMENTAL SAMPLES

3.9 Shipping Instructions - Environmental Samples

The following instructions apply to Environmental Samples only. If there is any doubt concerning the classification of a sample, consult your local HazMat Shipping Specialist or Regional Health and Safety Manager.

Step 1 - Follow all appropriate instructions for collecting the sample in accordance with the project work plan and/or sampling plan.

Step 2 - Secure the lid of the sample with tape.

Step 3 - Securely wrap the sample jar with bubble-wrap. Tape the bubble-wrap to the sample jar to ensure the sample jar does not slide out.

Step 4 - Place the wrapped sample jar inside a ziplock bag and zip the bag shut.

Step 5 - If the sample cooler has a drain plug, tape it shut on the inside and outside of the cooler.

Step 6 - Place 2 to 3 inches of vermiculite or other suitable non-combustible absorbent material in the bottom of the cooler.

Step 7 - Place a large garbage bag inside the cooler as a secondary liner.

Step 8 - Place the sample jars, contained in ziplock bags, inside the garbage bag.

Step 9 - Place bubble-wrap, or other suitable material that will maintain its integrity if it gets wet, between each ziplock bag to take up any void space.

Step 10 - If the samples are to be preserved to 4°C, place ice inside a ziplock bag. Place the bag of ice inside a second ziplock bag. Note: The number of bags of ice needed is up to the field team.

Step 11 - Place the double-bagged ice inside the garbage bag.

Step 12 - Secure the garbage bag with a twist-tie or knot.

Step 13 - Place chain-of-custody and other instructions inside a ziplock bag and tape to the inside lid of the cooler.

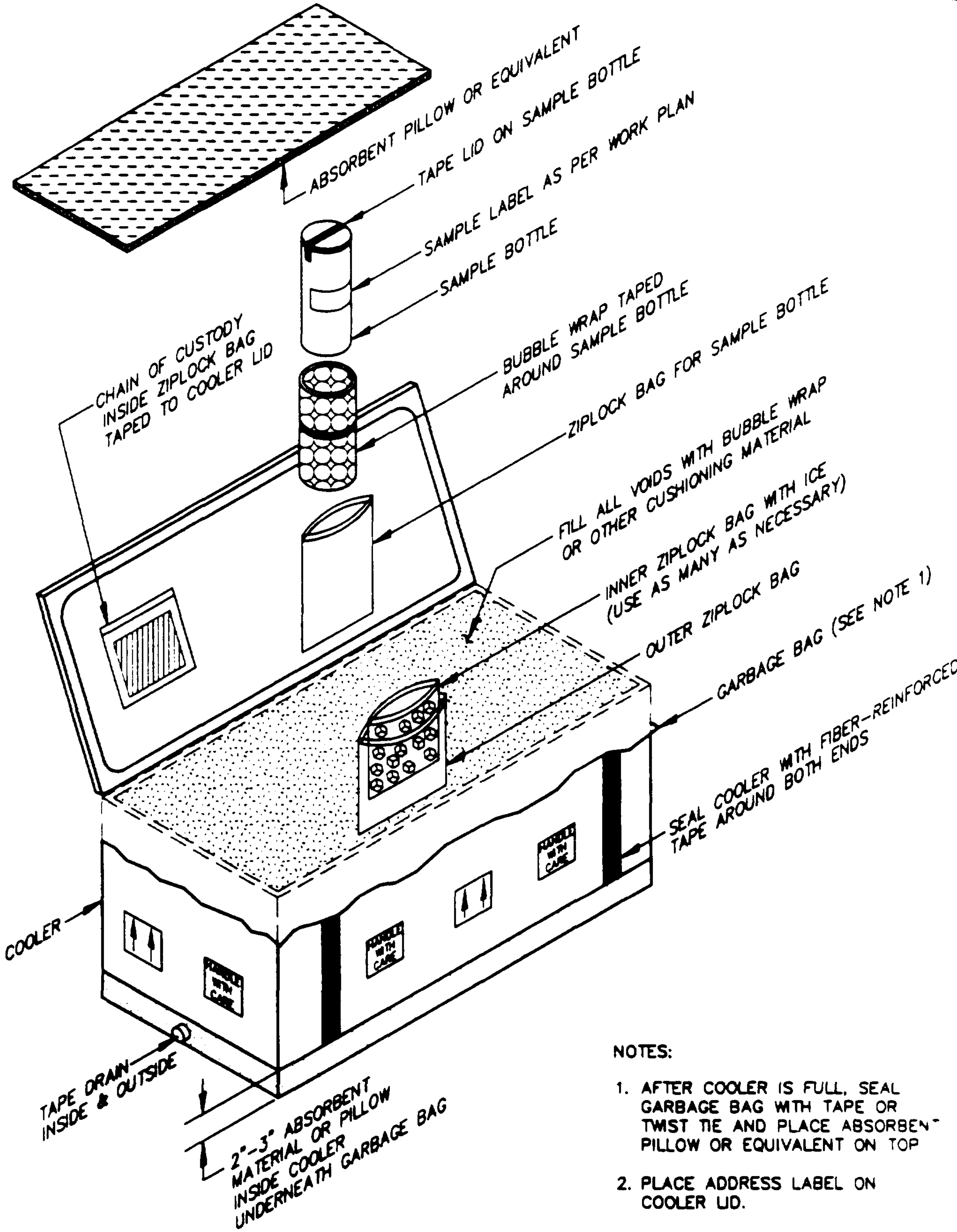
Step 14 - Close the cooler and secure closed with fiber-reinforced tape by running the tape around both ends of the cooler at least two times.

Step 15 - Place orientation arrows (↑↑) and "Handle With Care" stickers on at least two sides of the cooler.

Step 16 - Place address label with both the shipped from and ship to address on the top of the cooler.

Step 17 - Complete standard Federal Express or UPS airbill and attach to cooler. Maintain "shipper's copy" until samples have been received by the laboratory.

Figure 3.9-1 illustrates the above procedure. If any steps in this procedure do not apply to your situation or you cannot follow each step due to technical concerns, consult your local Hazmat Shipping Specialist or Regional Health and Safety Manager for additional details.



NOTES:

1. AFTER COOLER IS FULL, SEAL GARBAGE BAG WITH TAPE OR TWIST TIE AND PLACE ABSORBENT PILLOW OR EQUIVALENT ON TOP
2. PLACE ADDRESS LABEL ON COOLER LID.

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ENVIRONMENTAL SAMPLE SHIPPING INSTRUCTIONS

SCALE: NONE

FIGURE NUMBER 3.9-1